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

Document AVC-398R
November 6, 1992

SOURCE: CHAIRMAN OF THE EXPERTS GROUP FOR ATM VIDEO CODING
TITLE : REPORT OF THE NINTH MEETING IN IPSWICH AND LONDON (27 October - 6 November 1992) - PART I
Purpose : Report

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**Contents**



## 1. General

The ninth meeting of the Experts Group consisted of two parts; CCITT sole sessions in Ipswich and joint sessions with ISO/IEC JTC1/SC29/WG11 (MPEG) in London. The list of participants appears at the end of this report.

The first part was held during 28-30 October 1992 at Suffolk Grange Hotel in Ipswich, UK at the kind invitation of BT Laboratories. At the opening session, Mr. Geoff Morrison made a welcoming address on behalf of the hosting organization.

As to the membership of the group, it was announced that Ms Christel Verreth replaced Mr. Harald Brusewitz as Coordinating Member of Sweden.

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

## 2. Documentation (TD-2)

For this meeting 49 AVC-numbered documents and 15 temporary documents have been made available as listed in Annex 1.

## 3. Tape demonstration (TD-3)

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

## 4. Review of the previous meetings

4.1 Experts Group meetings (AVC-317R,318R,355R)

The outcome of the previous two meetings were briefly reviewed;

- New Jersey/Rio de Janeiro meeting in July 1992
- Tarrytown meeting in September 1992

At the Tarrytown meeting, "profile" of MPEG-2 was discussed as recorded in Annex 4 to AVC-355R. There was a question how H.26X be mapped onto the figure "Link between features and syntactic subset" in the Annex. Chairman stated his understanding that H.26X is identical to MPEG-2 in the common text approach, though the approach itself is subject to confirmation of the group, and clarified that the H.261 compatibility feature is included in the current syntax.

4.2 CMTT/2 SRG (AVC-388)

Mr. Zedler presented current activities of the CMTT/2 SRG, drawing attention to their concern with the HDTV/CTV compatible (or more appropriately scalable) scheme, reference model and evaluation procedure.

The meeting considered possible interaction methods, noting that the liaison representative for CMTT/2 SRG is still in vacancy. A conclusion was that we maintain the current method of interaction by exchanging liaison statements.

4.3 IVS Technical Session (AVC-320,357;TD-9)

This Technical Session was held in advance of the present meeting of the Experts Group at the same venue. Out of 34 participants from CCITT, CCIR and ISO/IEC, 16 were from the Experts Group.

Mr. Dorman, organizer of the Technical Session, presented summary of the two day discussion and requested of the following actions by the Experts Group and WPXV/1;

- to update the SGXV work plan,
- to send liaison statements to SGXVIII, to follow the open issues identified at the IVS Technical Session as in TD-9.

**5. Picture format**

5.1 Applications (TD-6)

The meeting took note of TD-6, Japan contribution to WPXV/1, which lists possible applications on B-ISDN. Implications to the audiovisual Recommendations are to be extracted.

5.2 Choice for H.26X or H.32X (AVC-377)

The choice of coding format(s) out of

- single format
- multiple formats
- flexible formats inside an agreed maximum

and a method to guarantee interregional communications have long been studied. In the light of lacking clear application possibilities, AVC-377 proposed to make H.26X a generic coding standard and to commence when appropriate on "application profiles" which will include picture formats, bit rates and other parameters. The meeting agreed to this proposal, recognizing that the issue is transferred to the H.32X terminal specifications.

5.3 Reflection to the video syntax

Even if specific formats are defined in a Recommendation other than H.26X, H.26X should have sufficient indications of possible formats. Relevant sequence header information in the TM2 document was reviewed and found that currently there is no item specifying interlace/progressive. This should be actioned at the London meeting.

**6. Source coding**

6.1 TM2 performance (AVC-394; AVC-365,395)

Basic performance of the TM2 was reported. AVC-394 compared 2 Mbit/s operations of TM2 with CCIR-601 format and MPEG-1 with SIF and showed that the former is much better subjectively. It was understood that difference is largely due to format conversion, not to coding kernels (MPEG-1 or TM2) and that it is advisable to directly encode full format rather than reducing format, coding, decoding and enlarging.

Two contributions (AVC-365,395) reported performance of TM2 at a higher format of 1920 pels x 1024 lines. It was requested to consider D1 demonstration at the next meeting by using the method of CMTT/2 SRG. It was also advised that if there are any considerations particular to higher formats, they should be reflected to the Test Model.

During the discussion, there was a question on appropriate pre-processing such as down sampling. Mr. Kosugi answered that 2/3 resolution reduction may be appropriate for 30 Mbit/s and Mr. Raychaudhuri indicated a US example of 1440x960 pels for about 20 Mbit/s. Mr. Haskell pointed out that TM2 method of 4:2:0 chrominance subsampling may not be sufficient for vertical resolution and that progressive materials are interested in this respect.

6.2 Low delay mode

*6.2.1 Prediction*

Intelligent prediction is the issue, but we have to await inputs to the joint sessions in London.

*6.2.2 Picture header for skipped pictures* (AVC-362)

The issue has been whether headers of skipped pictures are sent and what syntax is appropriate if sent. The meeting agreed to the proposal of AVC-362 to send the skipped picture headers by using a new picture type, which indicates the decoder not to take time for displaying skipped pictures, but specific code assignment is subject to coordination with other similar requirements.

This syntax would be in addition to, not replacing, the existing possibility to have pictures with no bits other than headers allocated to them. Though the latter method is recognised as incurring more delay in decoders, this may be irrelevant for some applications, yet remains totally in accordance with the existing syntax.

Communication with MPEG/SYSTEM sub-group is considered necessary on the impact of skipped pictures as to e.g. VBV delay consideration. This should be actioned in the joint sessions.

*6.2.3 Selection of skipped pictures* (AVC-363)

Based on the demonstration results showing no significant difference between skipping pictures in coding order and displaying order for M=2 field picture structure, the meeting supported to skip pictures in the coding order.

6.3 Cell loss resilience

*6.3.1 Spatial localization* (AVC-360,361,368,386)

Spatial localization of the cell loss damage is achievable by structured packing and/or concealment. The four contributions address the following items;

- AAL and video syntax specifications to support the structured packing,
- structured packing and/or concealment,
- structured packing vs slice size reduction.

During the discussion, the following questions and comments were raised;

- An open question is whether the structure of video is to be related to the structure of cell. Structured packing causes penalty for all users; adjustable mechanism is preferable.
- If the entry point is buffered with coded video data, coding control may become complex and difficult.
- Cell loss resilience should not be embedded in the source coding; codec must know the cell boundary. It would make implementation and standard complex. An opposing view is that we should include necessary elements in the video syntax so that they may be used when necessary, and experience shows implementation is not complex.
- Structured packing for a multiplexed bit stream may be achievable by using the system level elements (packet start code, slice start code), this needs study.
- We need some preventive measure for unavoidable cell loss, even if it takes place infrequently. An opposing view is that if infrequent, simple cyclic intra refresh may be acceptable.

As a conclusion, the following actions are necessary;

- study of structured packing for user multiplexed case, including system level implementation,
- comparison between the structured and reduced slice size,
- consideration for how ATM specific part be included in the generic coding.

*6.3.2 Temporal localization* (AVC-393)

Temporal localization of cell loss damage is achievable by leaky prediction or cyclic intra refresh (picture, slice, column). For this meeting, leaky prediction results were presented with tape demonstration.

*6.3.3 Leaky prediction*

1) Coding efficiency (documents for the previous meetings; Section 5.5/AVC-355R; AVC-393)

It was concluded that leaky prediction is competitive against the perfect prediction with cyclic intra refreshing.

2) Limit cycle fix (AVC-358,392)

Independent experiments showed that AVC-392 gives a solution.

3) Noisy back ground (Annex 3 to AVC-358,393)

Independent experiments showed that this is still a problem awaiting solutions. During the discussion, the following possible solutions were suggested;

- careful adaptive quantization, i.e. finer quantization for stationary backgrounds
- stronger leaks for every third picture; rate control should be adapted and improved,
- fine quantization of dc components,
- differential coding of dc components.

4) Channel hopping (AVC-364)

Comparison of channel hopping performance among leaky prediction and three intra slice methods were demonstrated. It was pointed out that since the experimented intra slice methods start intra coding just after the channel change, the time to obtain a complete picture takes twice what was demonstrated at worst.

5) Mandatory or optional

There was some discussion whether this leaky prediction be mandatory in the standard. One view was that every decoder should have this functionality since only trivial additional cost (hardware, syntax) is required and that the standard should allow both perfect and leaky predictions. Another view was that it should be optional since a cure should be found for the noisy background, and performance have not yet been verified at range of bit rates, for fade in /fade out sequences, {M=3, N=9}, HDTV at lower bit rates.

This matter is left open, awaiting more experimental results. The issue of demarcation between mandatory and optional needs to be sorted out also in the wider context of generic standard.

*6.3.4 Spatially/frequency scalable layered coding* (AVC-375,380,381)

The three contributions reported experimental results on the following;

- comparison between two layered coding with single layered (simulcast) coding
- use of concealment based on MPEG-1, with motion vector enhancement and prediction errors
- use of concealment based on upsampled MPEG-1 without motion vector enhancement

The meeting discussed how the findings through these experiments be reflected to the standard. Since there are no new syntax elements required for this type of cell loss resilience, the information should appear in informative annexes of the standard.

As to the method for cell loss generation, the current method described in the TM2 document (Section F.1.7/AVC-356) has been found to cause the actual cell loss rate to be higher than the desired value. A complete solution is expected by the next meeting; in the mean time the number of initial shift of the register should be changed to 10000 from 100 with a note indicating that this solution is still provisional. This should be actioned at the joint sessions in London

*6.3.5 Frequency scanning* (AVC-385)

A method for experiments of resolution and SNR scalable scheme is given in AVC-385, which has already been incorporated in the revised version of TM2 (AVC-356). It was noted that this scheme requires no modification in the source coding part, that the value of "n" is subject to experiments and that the frequency scanning gives 10% better efficiency for I-pictures and no change for P- and B-pictures.

Experiments are awaited.

*6.3.6 Use of priority* (AVC-376,387)

AVC-376 gave analytical results for effectiveness of leaky prediction and prioritizing coded video linked with layered coding. Those who have interests are suggested to get contact with the original author or Mr. Biggar.

AVC-387 gave a case study for the relation between generic source coding/decoding and transport media specific channel coding. A particular feature of this example is that MPEG-2 decoder needs "error token bit" interface (8 pins in an implementation).

Chairman drew attention of the members that we should identify ATM communication particular functionalities (or syntax elements) as soon as possible so that they be included in widely available chips. Mr. Morrison noted in this respect that first chips usually need revision and if additional requirements are found in the mean time, they may be easily accommodated in the second version. Mr. Raychaudhuri further pointed out that the third version may come after a much longer interval.

*6.3.7 Summary and additional experiments* (TD-11,12)

Mr. Biggar undertook to chair a small group for summarizing the cell loss resilience study results and identify necessary syntax elements and additional experiments. The outcome is contained in Annex 3.

Mr. Bjoentegaard undertook to chair a small group for summarizing the leaky prediction study results and identify necessary additional experiments. The outcome is contained in Annex 4.

6.4 Compatibility

*6.4.1 Spatio-temporal weighting* (AVC-367,379,382,390)

The four contributions reported experimental results on the spatio-temporal weighting for the spatially scalable scheme, showing some coding efficiency improvements. The meeting considered possible reasons for this;

- noise reduction similar to the effect for B-pictures,
- effectively loop filtering higher frequencies,
- rescuing uncovered backgrounds,

and got some suggestions for further experiments; frequency dependent weighting, adaptive quantization allocation between two layers, interlace-interlace as well as progressive-interlace cases. The benefit of this new technique is reduced by the overhead of sending upper layer motion vectors for those compatibility coded macroblocks that take some of their prediction from the upper layer.

The meeting also considered how to standardize weighting coefficients. Mr. Parke announced that he would submit a contribution proposing a syntax involving down loadable coefficients.

As to the additional memory bandwidth issue pointed out in AVC-367, it was suggested in the discussion to restrict the number of reference fields for B-pictures to 2 at maximum.

*6.4.2 H.261 compatibility* (AVC-359,390)

The two contributions reported performance when the base layer is coded by H.261, particularly at low bit rates. Difference of coding algorithm for the lower layer (MPEG-1, H.261) has been found insignificant. Importance of co-locating spatial position between low/high layer pictures for down- and up-sampling was pointed out.

The meeting shortly considered whether all the H.26X encoders and decoders are required to have this embedded coding capability, but did not reach a unified view. Further consideration is required in the context of "application profiles".

*6.4.3 Definition of upsampling filters* (AVC-366)

AVC-366 raised the following questions regarding the upsampling filters which should be standardized;

- spatial upsampling from CIF to higher formats,
- temporal upsampling from CIF to higher formats,
- processing over macroblock boundaries,
- pel values outside the picture boundary,
- multiplexing method for two layer video signals.

For the upsampling filters, a generic approach of down loading coefficient values and specifying arithmetic precision was suggested (see *6.4.1* above) to cope with a wide range of different combinations of low and high layer pictures. Temporal repetition can be covered as a degenerate case of interpolation. Some members expressed skepticism for this variable filter approach on the ground that upsampling filters from CIF may be limited in number. Multipoint communication is also to be checked.

The issue of macroblock boundaries was clarified to be coming from the current description of TM2 (Section G.2.1/AVC-356). Processing over macroblock boundaries is considered reasonable. Pel values outside the picture boundary was provisionally set to 128.

As to the multiplexing method for two video signals of different layers, Mr. Morrison suggested to solve it by the system multiplex, noting that the MPEG-1 system has a mechanism to deal with this multiplexing. Mr. Haskell drew attention to that MPEG-1 system assumes one buffer for multiplex stream. Its implications should be analyzed.

Related to the multiplex, there was also discussion on pros and cons (necessary bit rates for each layer, delay, implementation) of the following schemes to achieve compatibility among terminals of different generation standards;

- embedded compatible coding,
- frequency scalable coding,
- simulcast.

This system issue should be tackled by SGXV; this Experts Group and WPXV/1. For example, simulcast may be applicable to LAN environments where bit rate is not so restrictive, while embedded coding is effective in bit saving sensitive communications such as international videoconferencing.

*6.4.4 Additional experiments* (TD-12)

Mr. Parke undertook to chair a small group for summarizing the compatibility study results and identify necessary syntax elements and additional experiments. The outcome is contained in Annex 5. Members are particularly requested to contribute to the H.261 compatibility experiments.

6.5 Scalability (AVC-393)

AVC-393 demonstrated that leaky prediction cures the drift of lower resolution scales in the single loop frequency scalable coding.

6.6 VBR

*6.6.1 Traffic control and congestion control in B-ISDN - Rec. I.371* (AVC-321)

Recommendation I.371 to be approved in March 1993 contains

- specifications for traffic description and parameters; definition of peak cell rate, etc.
- functions and procedures for traffic control and congestion control; UPC/NPC, priority control and selective cell discard, etc.

*6.6.2 Traffic shaping* (AVC-372,389; TD-13)

AVC-372 reported hardware experimental results on the necessary size of leaky bucket to obtain constant picture quality and low delay. As far as the two experimented sequences are concerned, an order of 30 seconds is required for the former, while an order of 0.1 second can be sufficient for the latter.

The meeting decided to send this information to SGXVIII as part of the liaison agreed at the New Jersey meeting (Section 6.5.2/AVC-317R) which describes our strong concern with time constant of the UPC characteristics for the average rate. Mr. Yano undertook to draft this liaison statement as contained in Annex 6, noting that the used UPC mechanism is leaky bucket (not sliding window), and requesting SGXVIII's response to the possibility of measurement over a period of 10 seconds or more.

AVC-389 provided information on a traffic shaping method using mean bit rate, peak bit rate, time scale during which bit rate is constant and factor for bit rate change. This method allows the network to make a source model and accommodate a larger number of VBR sources. The contribution reported results for two different time scales.

## 7. Network aspects

### 7.1 B-ISDN service aspects - Rec. I.211 (AVC-322)

Recommendation I.211 to be revised next March contains service classification, general description of network aspects, and video services and coding aspect.

### 7.2 Video clock recovery (AVC-371,378)

Based on the previous agreement that for high quality applications video sampling clock frequency of the encoder should be conveyed to the decoder, several methods were compared in performance and adaptability to various environments.

The meeting reached a common view that this functionality should not be included in the ATM specific part.

AVC-371 proposed usage of common B-ISDN network clock while AVC-378 suggested the use of MPEG-1 system functionality comprising time stamps and buffer fill information. A previous contribution AVC-315 reported an implementation example for the AVC-371 approach. A concern was expressed to the MPEG-1 system method that the system need always be supported, not allowing the use of video bitstream only.

Since the common usage of the high quality network clock at both ends provides good jitter performance, there will be a possibility to combine the two approaches for B-ISDN applications. Further elaboration is requested.

### 7.3 Multimedia multiplex

#### *7.3.1 Comparison of alternative solutions for H.22X* (AVC-370,373; AVC-396)

AVC-373 provided a discussion material for multimedia multiplexing methods in integrated audiovisual terminals, taking MPEG-1 system as a possible multiplexing structure. It also addressed demarcation between generic part and media/application dependent part in the total system. Mr. Morrison and Mr. Haskell gave some answers to questions listed in Section 3 of this contribution regarding the MPEG system for multiplex and synchronization (see also AVC-396) including a fact that it may not conflict with the VC multiplex in B-ISDN. It was also clarified that registration and management of stream-ids had been recognized at the Rio meeting. In our case, several additional stream-ids would be required for terminal-to-terminal negotiation, auxiliary data transmission, etc.

The issue is whether a common multiplex method can be used across different applications such as conversational, storage and retrieval, distributive services. Since multiplexing and demultiplexing is usually implemented with software, transcoding approach may possibly be practical even if different methods become necessary for different applications.

During the discussion, it was recognized that the user multiplex method for the B-ISDN terminals may have two alternatives; H.221 like bit oriented multiplex and MPEG system like packet (byte) oriented multiplex. This should be studied and clarified in this group as well as in WPXV/1.

It was also recognized that bit error correction need more attention. One thought is that bit error characteristics are transport or storage media dependent, thus it should be included in ATM specific part in our H.32X terminal case.

AVC-373 gave a revised table for comparison of multimedia multiplex alternatives. It was pointed out that "User multiplex" should be split into two possible solutions, H.221 based and MPEG system based, reflecting the above discussion. Mr. Biggar and Mr. Tanaka undertook to further update this table for inclusion in the IVS Baseline document. The draft will be circulated among members for review, further improvements are welcome in this process. A liaison statement to SGXVIII for this purpose will be finalized by mid December.

*7.3.2 Hierarchical capability solution* (AVC-383)

This contribution provided a hierarchical approach for multimedia multiplex; to define several classes. The meeting confirmed our previous decision that the support of H.320 terminal emulation is essential for H.32X terminals.

7.4 AAL

*7.4.1 AAL Type 1 - Rec. I.363* (AVC-319)

Recommendation I.363 to be revised next march gives specifications of AAL Type 1 amongst others. The content was presented at the Stockholm meeting.

*7.4.2 AAL Type 2* (AVC-369)

This contribution provided a discussion material for two AAL Type 2 alternative solutions for video support and listed study items for the choice. There was a comment to "demerit" in Table 1 that use of video stuffing can solve the cell assembly delay. Buffer regulation problem in VBR video transmission was also recalled (see AVC-56). Further digestion and elaboration are requested toward concluding a preferred AAL for video support.

*7.4.3 AAL Type 5* (AVC-397)

This new type of AAL has been developed for data applications, but it may be applicable to our audiovisual communication purposes.

7.5 Support of H.320 terminals on B-ISDN (TD-4)

The meeting agreed to send a liaison statement to SGXVIII on the subject matter as contained in Annex 7.

**8. Very low bit rate videophone** (AVC-384,391; TD-7,8,14)

AVC-384 demonstrated performance of H.261 like algorithm at 8 and 16 kbit/s, suggesting that the necessary modification should carefully count on the effect of image quality. AVC-391 provided information on an implementation of the very low bit rate videophone.

Based on the discussion in the previous two meetings and information made available this time, the meeting agreed to make the following reply to WPXV/1;

- to report the discussion as recorded in TD-8,
- to propose the establishment of a new experts group dedicated to this study item, which cover the short term work and preparation for the long term work.

Mr. Eude undertook to draft terms of reference of and some suggestions for this experts group. The meeting reviewed this draft and approved its revision as contained in Annex 8.

**9. Work plan** (AVC-320,357,374; TD-5)

Mr. Biggar advised in TD-5 that the Experts Group should establish firm objectives so we could know what Recommendations we would be producing. AVC-374 further suggested that the group identify

- design component,
- its options,
- input required,
- impacts,

to produce detailed work program and to align them with those of SGXVIII and SGXI. The meeting at large and a small group of volunteers discussed how we can make our work more productive.

We have been concentrating so far on achieving a generic video coding standard H.26X aligning with MPEG-2 according to the decision at the first meeting of the group in November 1990. Most of our efforts have been to incorporate functionalities of our concern (such as low delay, cell loss resilience, H.261 compatibility) from the audiovisual communication system point of view. A difficulty is in the discrepancy between the freezing time of specifications (March 1993) and the time when B-ISDN network services will be made available for our applications (1995 or beyond?), but this way of working is generally considered right and profitable to CCITT.

Chairman sought the support of the group to take the common text approach for H.26X|MPEG-2. Due to the time discrepancy mentioned above, there may happen a situation that new unknown requirements are found after the specification freezing time. This should be taken into account and necessary procedures for adding new specifications in the future should be checked against CCITT and ISO/IEC rules. With this proviso, the meeting supported the common text approach, subject to confirmation of Working Party XV/1. Desire of MPEG to seek the common text approach with CCITT should also be confirmed.

During the discussion, Mr. Parke raised a question whether we could reach the point of freezing specifications next March if the volume of experimental works required are taken into account. It is pointed out that the MPEG resolution at Angra dos Reis includes "the requirements in WG11 N0233 have to be met in March 1993, if not the WD cannot be frozen".

We recognize that the generic coding approach leaves many system issues to the terminal Recommendation H.32X. To make a complete interworkable system, we need standards for multimedia multiplex (H.22X), communication procedures (H.24X), call control (AV42X) and whole terminal (H.32X). Though strictly speaking these are not under responsibility of the Experts Group, this group is an only body in WPXV/1 working for B-ISDN audiovisual systems, thus wishes to contribute to the progress. We should draw attention of Working Party XV/1 to this situation. In this sense, the suggestion in AVC-374 is helpful and should be implemented.

Chairman will draft a list of open issues after the meeting for review of the members, which will include priorities in terms of time schedule, missing information and linkage with applications.

The following advice was also given to improve the group productivity;

- Currently contributions are based on interests of the members, thus tend to diverge to many topics. Prioritizing the issues will make our work more convergent. Prioritizing applications will be useful.
- If prioritizing applications is difficult, case studies for typical applications will help us.
- Assigning a specific task to a specific person or task force.
- Exchange of opinions through correspondence during the interval of two meetings. However, there was some concern of adjusting with regional coordination.
- Adaptation (or extension) of existing H.320 terminals to ATM environments may be a work item of the group.

**10. Joint sessions with MPEG**

10.1 Documents

The following documents are put forward to the joint sessions (documents on the clock recovery will be submitted after a firm conclusion is obtained);

- Information/discussion:

AVC-357,358,359,360,361,363,364,365,366,367,368,370,375,379,380,381,382, 384,385,390,391,392,393,395
TD-10,11,12

- Proposal: AVC-362

10.2 Representatives

| | |
|---|---|
| CCITT EG | S. Okubo, G. Morrison |
| Requirements | S. Okubo |
| Video | G. Bjoentegaard |
| System | B. Haskell |
| Implementation | G. Morrison |

## 11. Others

11.1 Progress report to WPXV/1 (TD-8)

Incorporating the outcome of this meeting, revision of TD-8 is sent to WPXV/1 which will meet during 5-10 November in Geneva. The following items are listed for particular consideration of WPXV/1;

1) Work plan for broadband audiovisual Recommendations,
2) Common text approach for H.26X|MPEG-2,
3) Very low bit rate videophone activities.

11.2 Future meetings

| | Sole sessions | Joint sessions |
|---|---|---|
| January 1993 in Italy | 21-22 January | 25-29 January |
| March/April 1993 in Australia | 5-7 April (Melbourne) | 29 March - 2 April (Sydney) |

END

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**Annexes**

Annex 1 Documentation
Annex 2 List of tape demonstrations
Annex 3 ATM cell loss resilience framework
Annex 4 Potential with the use of leaky prediction
Annex 5 H.261 compatibility
Annex 6 Liaison statement to SGXVIII on VBR video coding advantage vs UPC time constant
Annex 7 Response to the liaison from SGXVIII on support of H.320 terminals in B-ISDN
Annex 8 Proposed terms of reference of Experts Group for Very Low Bitrate Visual Telephony

Participants of the ninth meeting of
Experts Group for ATM Video Coding
(27 October - 6 November 1992, Ipswich and London)

| | | | I | L | |
|---|---|---|---|---|---|
| FRG | Mr. F. May | Daimler-Benz | X | | CM |
| | Mr. G. Zedler | DBP Telekom | X | | CM |
| Australia | Mr. M. Biggar | Telecom Australia | X | X | CM |
| | Mr. D. Dorman | Telecom Australia | X | | |
| Belgium | Mr. O. Poncin | Belgacom | X | X | CM |
| Korea | Mr. J-Y. Nam | ETRI | X | X | CM |
| USA | Mr. V. Eyuboglu | Motorola | X | | |
| | Mr. B.G. Haskell | AT&T Bell Labs | X | X | |
| | Mr. D. Klenke | CLI | X | X | |
| | Mr. J. Normile | Apple Computer | X | | |
| | Mr. N. Randall | DIS | X | X | (CM) |
| | Mr. D. Raychaudhuri | David Sarnoff | X | | |
| | Mr. A. Tabatabai | Tektronix | X | X | CM |
| | Mr. Z. Yuan | PictureTel | X | | |
| France | Mr. G. Eude | CNET | X | X | |
| | Mr. J. Guichard | CNET | | X | CM |
| Italy | Ms. L. Conte | CSELT | X | X | CM |
| Japan | Mr. K. Hibi | Sharp | X | X | |
| | Mr. Y. Kato | Mitsubishi | X | X | |
| | Mr. J. Kimura | Hitachi | X | X | |
| | Mr. Y. Kosugi | Tokyo Electric Power Co. | X | X | |
| | Mr. S. Okubo | NTT | X | X | Chairman |
| | Mr. T. Tanaka | NTT | X | X | CM |
| | Mr. H. Ueno | Toshiba | X | X | |
| | Mr. M. Wada | KDD | X | | CM |
| | Mr. M. Yano | NEC | X | X | |
| | Mr. T. Yukitake | Matsushita Communication | | X | |
| Norway | Mr. G. Bjoentegaard | NTR | X | X | (CM) |
| Netherlands | Mr. D.A. Schinkel | PTT Research | X | | CM |
| | Mr. A. Koster | PTT Research | | X | |
| UK | Mr. D. Beaumont | BT | X | | |
| | Mr. N. Kenyon | BT | X | X | |
| | Mr. D.G. Morrison | BT | X | X | CM |
| | Mr. I. Parke | BT | X | X | |
| Sweden | Ms. C. Verreth | Telia Research | X | X | CM |

CM: Coordinating Member
(CM): Substitute for CM

Documents for the Ipswich/London meeting
(27 October - 6 November 1992)

## Normal Documents

*Note - [92/nnn] indicates MPEG92/nnn.*

AVC-317R REPORT OF THE SEVENTH MEETING IN NEW JERSEY AND RIO DE JANEIRO - PART 1 (CHAIRMAN)
AVC-318R REPORT OF THE SEVENTH MEETING IN NEW JERSEY AND RIO DE JANEIRO PART 2 (CHAIRMAN)

These two documents report the outcome of the previous meeting in July 1992.

AVC-319 I.363 - B-ISDN ATM ADAPTATION LAYER (AAL) SPECIFICATION (SGXVIII)

Specifications for AAL Type 1 are provided covering services, interaction with the management and control planes, functions of AAL Type 1, SAR syblayer and CS sublayer. This revision will be approved in March 1993.

AVC-320 IVS BASELINE DOCUMENT (SGXVIII)

This is a version revised at the June meeting of SGXVIII to align it with other I-series Recommendations and to reflect comments from other groups including this Experts Group.

AVC-321 I.371 - TRAFFIC CONTROL AND CONGESTION CONTROL IN B-ISDN (SGXVIII)

This Recommendation to be approved in March 1993 contains 1) specifications for traffic description and parameters; definition of peak cell rate, etc. and 2) functions and procedures for traffic control and congestion control; UPC/NPC, priority control and selective cell discard, etc.

AVC-322 I.211 - B-ISDN SERVICE ASPECTS (SGXVIII)

This Recommendation to be revised in March 1993 contains service classification, general description of network aspects, and video services and coding aspect.

AVC-355R REPORT OF THE EIGHTH MEETING IN TARRYTOWN (CHAIRMAN)

This meeting report presents the outcome of sole and joint sessions held in September 1992 to elaborate the video Test Model.

AVC-356 TEST MODEL 2 - REVISION 2 (TEST MODEL EDITING COMMITTEE)

Corrections and clarifications obtained at the Tarrytown meeting were incorporated.

AVC-357 STATUS REPORT ON ATM VIDEO CODING STANDARDIZATION, ISSUE 3
[92/576] (EXPERTS GROUP)

Study results since September 1991 have been incorporated covering such items as picture format, video coding algorithm, VBR issue, multimedia multiplexing, network aspects, work plan.

AVC-358 EFFECT OF PSEUDO-RANDOM SIGNAL INSERTION IN LEAKY PREDICTION
[92/577] (JAPAN)

The solution for the limit cycle problem proposed in AVC-349 has been evaluated in three independent experiments, concluding that it solves the limit cycle problem without affecting coding efficiency, but "noisy background' still exists and need another fix.

AVC-359 SIMULATION RESULTS ON H.261 COMPATIBILITY AND SCIF (JAPAN)
[92/578]

Compatibility experiments are reported where CIF pictures are used as base layer for coding CCIR601 or SCIF pictures. It is suggested that up-sampling filter characteristics and frame rate of the base layer pictures may largely affect the coding performance.

AVC-360 STRUCTURED PACKING (JAPAN)
[92/579]

Four different proposals regarding the structured packing method are compared in the light of impacts on AAL and video syntax. It is clarified that AAL should support an entry pointer as well as structured data handling, while an absolute addressing mechanism is the requirement for video syntax. It is concluded that further consideration is needed for the best balance among cell loss resilience, AAL/bit stream generality, and coding efficiency. Further study for multiplexed signals is also pointed out.

AVC-361 SPATIAL-DOMAIN COMPENSATION FOR CELL LOSS (JAPAN)
[92/580]

Two methods for spatial localization of cell loss, structured packing and concealment, have been experimented for Flower Garden and Mobile & Calendar at 4 and 9 Mbit/s, concluding that they cooperatively contribute to the cell loss resilience, thus are necessary for sufficient cell loss compensation.

AVC-362 PICTURE HEADER OF SKIPPED PICTURES (JAPAN)
[92/581]

It is proposed to send picture headers for skipped pictures by using a new picture_coding_type "skipped (S)" where there is no slice layer data included.

AVC-363 COMPARISON OF PICTURE DROPPING ORDER (JAPAN)
[92/582]

Based on picture skipping experiments for M=2 field pictures (Core Experiment H.2.5), it is concluded that there is no difference in subjective impression between coding order skipping and display order until the number of skipped pictures becomes 4, thus the former is suggested for its simpler rate control.

AVC-364 COMPARISON OF LEAKY PREDICTION AND INTRA SLICE ON CHANNEL HOPPING
[92/583] (JAPAN)

Four ways of display after channel hopping are demonstrated to evaluate leaky prediction against intra slice; 1) leaky prediction with leak factor of 15/16, 2) blue picture display until a complete picture is refreshed, 3) last decoded picture display until a complete picture is refreshed, 4) blue picture being wiped by each intra slice.

AVC-365 HDTV CODING BY TEST MODEL 2 (JAPAN)
[92/584]

Experimental results are reported for coding of two HDTV sequences with luminance resolution of 1920 pels by 1024 lines at 30, 45 and 60 Mbit/s by applying TM2 straight (M=1, N=60). Observation is made that 30 Mbit/s pictures contain some degradation (mostly granular noise) but 45 and 60 Mbit/s ones are almost free of artifacts.

AVC-366 UNDEFINED ITEMS IN COMPATIBILITY CODING (JAPAN)
[92/585]

It is pointed out that in order to complete the embedded compatibility coding algorithm the following three items should be defined; 1) upsampling filters to generate higher resolution pictures, 2) selection of corresponding lower layer pictures when picture rates are different between higher and lower layers including the case that picture skipping is involved in the lower layer, 3) multiplexing method for the two layer signals. Some discussion is also given to each item.

AVC-367 SIMULATION RESULTS ON SPATIO-TEMPORAL WEIGHTING (JAPAN)
[92/586]

Spatio-temporal weighting has been experimented for compatibility coding to obtain gains of 0.08 dB for Football and 0.25 dB for Flower Garden. Prediction efficiency is improved by this weighting, but the overall coding gain is reduced by the need of transmitting motion vectors for the upper layer as well. Memory bandwidth increase is also pointed out. As a conclusion, it is stated that the current prediction from the base layer is sufficient if total performance is considered.

AVC-368 RE-SYNCHRONIZATION BY SLICE SIZE REDUCTION (JAPAN)
[92/587]

Coding efficiency for the reduced slice size (22, 11, 4, or 2 macroblocks per slice) has been measured to evaluate it as an alternative method for spatial localization of the cell loss to the structured packing. It is reported that picture quality difference is distinguishable between 44 MB/slice and 4 MB/slice, but very small between 44MB/slice and 11 MB/slice. It is suggested that if concealment works well for 11 MB/slice, this method is competitive with the structured packing in performance, thus preferable for its generic nature (i.e. no need for ATM specific solutions).

AVC-369 CLARIFICATION OF AAL TYPE 2 (JAPAN)

Two AAL alternatives for video signal support are discussed; one allows partially filled cells, the other does not. The former tends to give better transmission efficiency while the latter guarantees the maximum transmission delay. Study items are listed toward defining AAL fields. Difficulty for bit error correction is also pointed out for the latter alternative.

AVC-370 MULTIMEDIA MULTIPLEXING METHOD OF AUDIOVISUAL COMMUNICATION (JAPAN)
[92/589]

Three configurations of the integrated services communication terminal are illustrated to draw attention to the multimedia multiplexing method; 1) multiplexing according to each application specific method at the sending side and multiple demultiplexers at the receiving side, 2) demultiplexing and remultiplexing at the sending side thus single demultiplexer at the receiving side, 3) common multiplexing and demultiplexing across different applications. Some study items are listed for applying the MPEG system as a generic multimedia multiplexing in a communication terminal.

AVC-371 VIDEO SOURCE CLOCK RECOVERY (JAPAN)

Supplementary discussions are provided for the previous document AVC-336 which proposed a picture header field for transmitting the video source clock information; choice of the video source clock, network clock availability, frequency information transmitting interval, and consideration for retrieval from DSM.

AVC-372 VBR CODING UNDER USAGE PARAMETER CONTROL (JAPAN)

Measured data of video information generation and leaky bucket fullness are reported for VBR operation of an H.261 real-time hardware, where UPC is given as average rate regulation by a leaky bucket having different sizes. It is concluded that to keep constant quality the bucket size should be of more than several tens of seconds in time while to obtain low delay it can be of several frames in time.

AVC-373 SUMMARY OF MULTIMEDIA MULTIPLEXING SYSTEMS (AUSTRALIA)

After discussing some items in the comparison table in AVC-129, particularly inclusion of CS multiplexing and benefits of cell-based multiplexing, an updated table is provided. It is proposed to send a new version with further consideration in the Experts Group to SGXVIII for inclusion in the IVS Baseline Document. Conveying the urgency of standardizing the network and signaling support of VC-based multiplexing to SGXI and XVIII is stressed. It is also suggested that the Experts Group should keep the decision of a final multimedia multiplexing method open until the actual cost of VC-based multiplexing becomes clear.

AVC-374 CONTRIBUTION TO WORK PLAN (AUSTRALIA)

It is suggested that the Experts Group should take a phased approach to the development of the coding standard, taking into account the same approach adopted for the development of B-ISDN standards. A table of work items is provided as a basis for a detailed work program of the Experts Group, listing

design component, options, inputs required and impacts. It is proposed that the Experts Group make this detailed work program and advise of the need for appropriate work in other groups, where necessary, to ensure that the overall system is developed.

AVC-375 RESULTS ON LAYERED CODER ERROR RESILIENCE (AUSTRALIAN UVC) [92/590]

Experimental results are reported for MPEG frequency scalable two layer coder with a single encoding loop in cell loss environments. Three cases are compared in cell loss resilience; two layer coding with cell losses in the upper layer only, the same with cell losses in the base layer as well, an single layer coding, each layer has its own error concealment. It is concluded that the layered coder without lower layer loss performs better than the single layer coder, as does the layered coder with lower layer loss as the overall cell loss ratio exceeds 0.001.

AVC-376 THEORETICAL STUDY OF THE USE OF PRIORITY (TELECOM AUSTRALIA)

Analysis for SNR performance of predictive coding is given for a statistically multiplexed situation. Particularly cell loss resilient techniques such as leaky prediction and prioritization coupled with layered coding are found useful when the utilization is high.

AVC-377 PICTURE FORMATS FOR H.26X (BELGIUM,FRANCE,ITSLY,NORWAY,NETHERLANDS,UK)

Due to the lack of information on dominant applications for H.26X, it is proposed that we should take a generic standard approach for H.26X and that CCITT activity should commence when appropriate on "application profiles" which will include picture formats, bit rates and many other parameters. It is also noted that we must make high quality options available for those who need and can afford them, instead of providing only high quality solutions which are above customers' real needs and rejected for cost reasons.

AVC-378 VIDEO CLOCK RECOVERY (BELGIUM,FRANCE,ITSLY,NORWAY,NETHERLANDS,UK)

Four different methods for the video clock recovery are compared in hardware complexity and functionality; half buffer aim, buffer fill information, signaling encoder video clock frequency, and time stamps. It is concluded to appear that the inclusion in the bit stream of data for the second and fourth methods offers the best route, leaving further study for verifying and extending the scope of the above analysis.

AVC-379 SPATIO-TEMPORAL WEIGHTED COMPATIBLE CODING CORE EXPERIMENT (UK) [92/591]

Experimental results are presented for the new selected weightings of the base layer prediction and the top layer prediction, reporting that gains of 0.19 dB, 0.12 dB and 0.16 dB have been obtained for P-pictures of Flower, Table and Calendar, respectively.

AVC-380 LAYERED CODING CELL LOSS EXPERIMENT (UK) [92/592]

Cell loss experiment results are presented for both one-layered simulcast coding and two-layered compatible coding. Video data prioritization is employed; high priority is given to 1) all picture, group and sequence headers as well as all intra picture data of the simulcast signal and the compatible coding upper layer signal, and 2) the compatible base layer signal, while all other dada are set to low priority. It has been shown that cell loss recovery using base layer data is more effective than cell loss recovery using previous picture data, and consequently two-layered coding is more resilient to cell loss than simulcast.

AVC-381 CELL LOSS EXPERIMENTS IN LAYERED CODING (PTT RESEARCH-NETHERLANDS) [92/593]

Experimental results are presented for a two-layered MPEG-2 pure field coding scheme where concealment techniques based on the full resolution frame memories instead of the MPEG-1 frame memories are employed. It has been shown that the concealment provides a high level of cell loss resilience while the picture quality is not acceptable without use of this concealment.

AVC-382 SIMULATION RESULTS OF SPATIAL-TEMPORAL WEIGHTING
[92/594] (PTT RESEARCH-NETHERLANDS)

Experiments on the spatio-temporal weighting which were carried out according to TM2.1 for field-structure pictures show coding gain of 0.2 dB and more smooth images with less noise than the TM2.1 image. It is also reported that simulation results show a gain in image quality (subjective impression and SNR) for compatible coding compared to simulcast.

AVC-383 TERMINAL CAPABILITY SETS FOR MULTIMEDIA SUPPORT
(NETHERLADS,UK,FRANCE,ITALY,BELGIUM,SWEDEN,FRG)

A notion of "capability set 0" and "capability set x" is introduced to sort out the multimedia multiplexing method issue. The former stands for minimum configuration which every H.32X terminal must offer, thus allows interworking between any level of H.32X terminals, while the latter stands for the maximum configuration which is possible for a H.32X terminal, thus allows use of the cell multiplex method, the SAR multiplex method and the message multiplex method. A lot of capability sets are possible between "capability set 0" and "capability set x", but they all must contain "capability set 0".

AVC-384 QUALITY CONSIDERATION ON VIDEO CODING ALGORITHM FOR SHORT TERM
[92/595] PSTN VIDEO TELEPHONE STANDARDISATION (NTR)

Results from the work in COST211ter shows that significant gain in image quality can be made by changing the prediction of H.261, use of half-pel accuracy motion compensation instead of the loop filter. It is also argued that a new coding algorithm should be close to H.261 with careful consideration of the effect on image quality.

AVC-385 CORE EXPERIMENT ON CELL LOSS RESILIENCE BY USING FREQUENCY
[92/596] SCANNING (BELGACOM,SIEMENS,HHI)

A method of experimentation is given to compare the impacts of cell losses on both the block scanning (basic mode) and the frequency scanning with MUVLC techniques. Global parameters and syntax modifications are described.

AVC-386 PROPOSAL FOR GENERAL ONE/TWO TIER MPEG TRANSPORT SYNTAX
(DSRC,TCE)

This document presents a specific MPEG-2 transport syntax, whose specification is based on a "structured packing" framework with fixed length packets of specifiable size. The protocol consists of three sublayers; 1) network, 2) adaptation, 3) video service. The network layer provides generic service multiplexing, scrambling and priority support for video delivery systems. The video adaptation layer is for efficient packing of variable length MPEG data into fixed length packets, as well as for providing error management facilities. The video service layer is an extension of the MPEG slice header concept, providing decoder resynchronization boundaries in the video bitstream.

AVC-387 DISCUSSION OF PRIORITY TRANSPORT OPTION FOR MPEG-2 (DSRC,TCE)

This document presents a discussion of how priority processing can be implemented in a practical MPEG-2 system and describes how the bitstreams can be synchronized (or resynchronized after data losses) at the decoder using the priority syntax. Implementation of interfaces between the generic source coding/decoding and transmission media specific prioritizer/VLD, and synchronization of prioritized bitstreams with losses are also discussed.

AVC-388 LIAISON LETTER FROM CMTT/2-SRG TO CCITT WPXV/1 EG ACV (CMTT/2-SRG)

The updated version of the SRG activity report is brought to the attention of Experts Group. The SRG has been focusing on the CTV/HDTV compatibility.

AVC-389 REGULATION SHAPING TECHNIQUE FOR VBR CODEC (FRANCE)

A traffic shaping technique consisting of four negotiated parameters (mean bit rate, peak bit rate, timescale during which the bit rate is constant and factor by which the bit rate can be increased or decreased from a timescale to another) has been experimented, using H.261. It is reported that picture quality has been enhanced and the mean bit rate has been preserved during the communications.

AVC-390 RESULT OF THE SPATIAL SCALABILITY/COMPATIBILITY EXPERIMENT: H.261
[92/597] BASED SPATIO TEMPORAL WEIGHTED COMPATIBLE MPEG2 CODING (FRANCE)

Experimental results are presented for the following four cases; 1) simulcast, 2) full compatible coding without spatio-temporal weighting, 3) spatio-temporal weighted field coding and 4) spatio-temporal weighted frame coding. Bit rates are 1.15 Mbit/s for the base-layer and 2.85 Mbit/s for the upper-layer. It is shown that the fourth compatible mode outperforms the other three compatible approaches with 1 dB gain compared to the simulcast for Flower Garden and Susie.

AVC-391 PUBLIC SWITCHED TELEPHONE NETWORK (PSTN) VIDEOPHONE (AT&T)
[92/588]

Design philosophy and some parameters of a PSTN videophone is given toward standardized videotelephony service, describing video coding algorithm, audio coding algorithm, modem algorithm, communication protocols and data transport services.

AVC-392 CORRECTION: ELIMINATING THE LIMIT CYCLE IN LEAKY PREDICTION (AT&T)
[92/598]

This document provides exact specifications for the limit cycle fix using a pseudo random signal which were proposed at the Tarrytown meeting.

AVC-393 EXPERIMENTAL RESULTS WITH LEAKY PREDICTION (AT&T)
[92/599]

Experimental results are presented on 1) equivalent quality with and without leak, 2) reduction of the noisy background, 3) cell loss resilience, 4) reduction of drift in the frequency scalable sequences, using TM2 frame-based coding with frame-based motion vectors at 4 Mbit/s.

AVC-394 TM2 SIMULATIONS AT 4 AND 2 MBIT/S COMPARED WITH MPEG-1
(DAIMLER BENZ - FRG)

Experimental results are presented for TM2 coding of the CCIR601 signal at 4 and 2 Mbit/s, and MPEG-1 coding of the SIF signal at 2 Mbit/s. It is concluded that TM2 at 4 Mbit/s is expected to give absolutely acceptable results for a wide area of video storage, exchange and distribution, and that use of SIF for MPEG-1 coding causes significant loss of spatial resolution and heavy motion jerkiness compared to full resolution coding with TM2.

AVC-395 HDTV VIDEO CODING USING MPEG2-TM2 (ETRI-KOREA)
[92/752]

Experimental results are reported for coding of two HDTV sequences with luminance resolution of 1920 pels by 1024 lines at 25 and 35 Mbit/s by applying TM2 straight (M=3, N=15). Observation is made that 25 Mbit/s pictures contain some quality degradation in the "Fashion Show" and granular noise in the "Locomotive" but 35 Mbit/s ones contain few artifacts. It is also pointed out that color sharpness need be improved, e.g. by using 4:2:2 instead of 4:2:0.

AVC-396 THE MPEG SYSTEMS SPECIFICATION AND MULTIPLEX
[92/549] (S.MACINNIS, G.MORRISON)

A broad overview is given to salient general features of the MPEG system which provides 1) decoding and precisely synchronized presentation, 2) multiplexing of 0 to many audio and video streams, 3) a means for coded data buffers in decoders not to overflow nor underflow, 4) decoding after a random access with a reasonable short delay, 5) absolute time identification information for stream(s), 6) very low systems overhead.

AVC-397 REPORT OF RAPPORTEUR'S MEETING ON AAL TYPE 5
(SPECIAL RAPPORTEUR SWP XVIII/8-5)

An updated text for AAL Type 5 specifications as well as a list of outstanding issues are provided as the output of Rapporteur's meeting held during 19-21 October 1992.

## Temporary Documents

| | |
|---|---|
| TD-1 | Agenda for the sole sessions in Ipswich (Chairman) |
| TD-2 | Available documents (Chairman) |
| TD-3 | List of tape demonstrations (Chairman) |
| TD-4 | Draft response to the liaison from SGXVIII on support of H.320 terminals in B-ISDN (Chairman) |
| TD-5 | Review of the Experts Group work plan (Chairman) |
| TD-6 | Applications of video coding for B-ISDN (Japan) |
| TD-7 | Comments on interworking between PSTN videophones and ISDN videophones (Japan) |
| TD-8 | Draft fourth progress report (Chairman) |
| TD-9 | Open issues (IVS Technical Session) |
| TD-10 | Report from the small group on leaky prediction (G. Bjoentegaard) |
| TD-11 | ATM cell loss resilience framework (M. Biggar) |
| TD-12 | H.261 compatibility (I. Park) |
| TD-13 | Draft liaison statement to SGXVIII on VBR video coding advantage vs UPC time constant (M. Yano) |
| TD-14 | Proposed terms of reference for Experts Group for Very Low Bitrate Visual Telephony (G. Eude) |
| TD-15 | Draft meeting report for the sole session in Ipswich (Chairman) |

List of Tape Demonstrations
(28 October 1992, BT Labs)

| No | Organization | Topics | Tape | Doc. |
|---|---|---|---|---|
| a | Fujitsu | Leaky prediction - limit cycle problem | D-60 | AVC-358 |
| b | NTT | Leaky prediction | D-60 | AVC-358 |
| c | NEC | Leaky prediction | D-60 | AVC-358 |
| d | NEC | VBR under UPC | D-60 | AVC-372 |
| e | AT&T Bell Labs | Elimination of limit cycles in leaky prediction | D-60 | AVC-392 |
| f | AT&T Bell Labs | Experimental results on leaky prediction | D-60 | AVC-393 |
| g | AT&T Bell Labs | Cell loss experiments for leaky prediction | D-60 | AVC-393 |
| h | AT&T Bell Labs | Drift reduction in frequency domain scalable sequences | D-60 | AVC-393 |
| i | Matsushita | Comparison of leaky prediction and intra slice on channel hopping | D-60 | AVC-364 |
| j | Matsushita | Comparison of picture skipping order | D-60 | AVC-363 |
| k | KDD | H.261 compatibility | D-60 | AVC-359 |
| l | Toshiba | Spatio-temporal weighting | D-60 | AVC-367 |
| m | Toshiba | Cell loss - slice size reduction | D-60 | AVC-368 |
| n | Fujitsu | Cell loss - structured packing and concealment | D-60 | AVC-361 |
| o | PTT Research | Cell loss | D-50 | AVC-381 |
| p | PTT Research | TM2, compatible coding, simulcast | D-50 | AVC-382 |
| q | BT Labs | Spatio-temporal weighting compatible coding | D-50 | AVC-379 |
| r | BT Labs | Cell loss in layered coding | D-50 | AVC-380 |
| s | BT Labs | Interlace to interlace conversion and compatible coding | D-50 | |
| t | CNET | Compatibility | D-50 | AVC-390 |
| u | Daimler-Benz | Comparison of TM2 and MPEG-1 at 2 Mbit/s | D-50 | AVC-394 |
| v | NTR | Very low bit rate coding | U-50 | AVC-384 |

ISO-IEC/JTC1/SC29/WG11
MPEG92/750
30 October 1992

CCITT Experts Group for ATM Video Coding
28-30 October 1992
Ipswich
TD-11

Title: **ATM Cell Loss Resilience Framework**
Source: CCITT Experts Group
Purpose: Discussion

### Objectives

Studies on ATM Cell Loss resilience for MPEG2/H.26X are to be carried out with the following principal objectives:

1. If possible, methods of cell loss resilience are to be defined using only the syntax elements provided for the standard profiles, and without linking the encoder directly to the ATM transmission elements. This is because:

   (a) The encoder is intended to be generic;

   (b) The encoded bitstream may have been encoded for purposes other than ATM transmission (e.g. read from a DSM).

Therefore, the aim should be to provide maximum cell loss resilience with the tools already provided by the MPEG2 profiles, and to describe a variety of techniques so that cell loss resilience can be provided for all bitstreams, although the level of protection will vary depending on the tools available.

2. Other techniques, which require syntax changes or two-way interaction between encoder and network interface to provide the necessary level of protection, should be identified and compared with those that do not. Only if these methods provide protection superior to that available otherwise, or in profiles that would not otherwise offer adequate cell loss resilience, are they to be accepted and any syntax changes recommended.

3. Reference methods of cell loss protection are to be described (not standardised) in informative text in the MPEG2/H.26X recommendation. The descriptions will include reference configurations and indicative levels of performance (e.g. CLR for which high picture quality can be maintained).

4. The fact that different profiles may be more suitable than others for cell loss resilience suggests that importance should be attached to the means by which the form of encoding can be translated. For example, transmission over a high-CLR ATM link may be best achieved if a single-layer MPEG2 bitstream read from a DSM can be transcoded readily into a layered representation.

### Assumptions

1. An underlying assumption in all of the cell loss resilience techniques is that the loss of a cell is known at the decoder. This has implications for the AAL, in that at least a cell sequence number should be provided.

## Cell Loss Resilience Methods - Description, experiments and status

**"Generic" solutions (no syntax changes needed, no feedback to encoder from network interface):**

1. Concealment at decoder. This method is an optional decoder-only operation that involves trying to hide cell losses through substitution of appropriate slice data. A simple example is use of the slice from the same location in the previous frame. A more sophisticated technique is described in AVC-368 (Fujitsu), and involves motion-compensated slice substitution.

Open issues: Appropriate concealment strategies
Method of estimating missing motion vectors
Slice size
For what CLR is this method effective?

2. Priority

Separation of low and high priority information for transmission over appropriate channels (using CLP bit or channels of different QoS). Possible means of separating the priority information are:

Frequency scanning (AVC-385)

I, P -> High priority, B -> Low priority (Reported at Rio meeting)

Use of priority necessarily involves a means of bitstream separation and merging (AVC-387).

Open Issues: Basis upon which data is to be separated into priority levels.

Need to control rates in each channel.

For what CLR is this method effective?

3. Layered Coding using different QoS.

Both the compatibility and scalability profiles offer encoded bitstreams that are layered and suitable for transmission using different priorities/QoSs. This method involves greater complexity but appears to offer best protection for high CLRs.

Open Issues: Applicability of each of the profiles (scalability and compatibility)

Need to control rates in each channel.

For what CLR is this method effective?

**ATM-specific solutions (requiring syntax changes or interactive working with the network interface):**

4. Structured Packing. This method requires a syntax extension to provide for absolute macroblock addresses (AVC-360). If the absolute macroblock addressing is not provided by the encoder, it is possible to post-process the bitstream to generate appropriate pointers (AVC-386).

Open Issues: For what CLR is this method effective?

5. Leaky Prediction. Defined in Core Experiment.

Open Issues: For what CLR is this method effective?

6. Frequency Scanning. Defined in Core Experiment.

Open Issues: For what CLR is this method effective?

7. Concealment Assistance. Some cell loss concealment techniques can be assisted if additional information can be provided through a change to the syntax. For example, the inclusion of motion vectors for intra-MBs means that motion compensated MB concealment is possible without the need for complicated motion vector estimation methods.

Other examples?

Open Issues: Does the performance gain provided by this method warrant the syntax change and small loss in coding efficiciency?

ISO/IEC
JTC1/SC29/WG11
MPEG92/ 749
November 1992

Source: CCITT Experts Group for ATM Video Coding.
Title: Potential with the use of leaky prediction.
Purpose: Discussion.

Relevant AVC documents: AVC-358, AVC-364, AVC-392, AVC-393.

Leaky prediction is attractive because it is simple to implement and gives possible solutions to several coding aspects. The table below list the coding areas where leaky prediction may offer possible solution. Alternative solutions to the same problems are also listed.

| Coding item | Alternative solution |
|---|---|
| **Regular update**<br><br>Relevant for:<br>• Channel hopping.<br>• Recovery after errors. | I - frames<br>I - slices (especially for low delay application). |
| **Drift in lower layers of frequency scalable sequences.**<br>Relevant for:<br>• Use of frequency scalability.<br>• Use of frequency layered coding for cell loss resilience. | Frequent INTRA update. |
| **IDCT mismatch**<br>Leaky prediction has a positive effect on the problem. | I - blocks. |

## Coding performance.

Leaky prediction means a sort of gradual update of the picture content. This kind of update will always reduce coding efficiency. Simulations so far show that leaky prediction compare favourably with methods including regular update like I - frames and I - slices.

## Problems with leaky prediction.

A couple of problems have been encountered during the tests of leaky prediction.

### Limit cycle problem.

This caused contouring effects in certain areas of the picture. The problem is now considered to be solved by adding noise to the signal before quantization. This is documented in AVC-392.

**Noisy background.**

This a disturbance visible in large even areas. It is mainly due to the coding of DC coefficients. With a leak, it means that the DC has to be recoded end the quantizer step size determines the accuracy of reconstruction. (Without leak the accuracy of reconstructed DC values in large even areas tend to be much smaller than determined by the quantizer).

The resulting noise have been particularly noticeable with M=1, Leak factor 15/16 and leaky prediction every frame. Several methods to "cure" this problem have been identified:

- Adaptive quantization. This means that MQUANT is used to reduce the quantizer step size in problem areas. The lower quantizer step size will make the noise less visible.
- Use of a larger leak factor - 7/8 instead of 15/16 - in every 3 frames instead if for every frame. According to document AVC-393 this solves the problem.
- Finer quantization of the DC coefficient.
- Differential coding of DC coefficients. This method has not been tried yet but is believed to have positive effect on the noisy background problem as well as saving bits for DC coding.

  The method works in the following way:
  - The prediction is performed on Y blocks within a INTER macro block.
  - For the first Y block in a macro block the prediction is set to 0 (or reset only if the previous macroblock was INTRA?)
  - For the remaining 3 Y blocks the previous decoded DC coefficient is used as prediction.
  - The differential DC coefficient as well as the AC coefficients are zing - sag scanned, quantized with the same quantizer step size and coded with the 2 D VLC.

## Conclusion

Leaky prediction offers an inexpensive solution to some important coding aspects. Solutions have been identified to problems like "limit cycle effect" and "noisy background". However, more work should be done to reduce the "noisy background". Some solutions are pointed out in this document. They should be further tested and analysed in order to be sure that the problem of "noisy background" is under control for all kinds of material.

ISO-IEC/JTC1/SC29/WG11
MPEG92/ 751
30 October 1992

CCITT Experts Group for ATM Video Coding
28-30 October 1992
Ipswich

TD12

Title: **H.261 Compatibility**
Source CCITT Experts Group
Purpose Discussion/Proposal

## Coding performance

Improvements were found when using the spatio-temporal weighting technique. The gain in SNR ranged from 0.07dB to 0.27dB when using MPEG-1 in the base layer. In the case when H.261 (RM8) was used in the base layer the improvement was between 0.48dB and 0.66dB (AVC-390).

Subjectively the pictures showed a small improvement compared with the previous compatible coding technique.

There was some discussion on where the improvement came from. Suggestions were

- noise is reduced by weighting of the predictions
- combination of low frequency component from base layer and higher frequency components from upper layer.

The benefit of this new technique is reduced by the overhead of sending upper layer motion vectors for t hose compatibly coded macroblocks that take some of their prediction from the upper layer.

## Further experiments

- experiments needed on 30Hz CIF (base layer) and 25Hz 601 (upper layer) (temporal upsampling)
- frequency weighted prediction
- how to reduce the motion vector overhead of spatio-temporal weighting.
- filters for upsampling (accuracy, number of taps required for implementation purposes)

## Agreements

There was agreement on the following:

that prediction should only come from two fields. This means that there is no compatible prediction for bidirectionally predicted macroblocks in B pictures.

- the upsampling filters should be able to cross block boundaries
- pixels accessed outside active picture area should be set to the value 128.

## Other Issues

AVC-366 identified the following issues to be resolved:
- there will be many spatial and temporal upsampling filters needed, the H.26x syntax will need to support this.
- multiplexing of layers of video.

# Liaison Statement to SGXVIII on VBR Coding

Source: SGXV Experts Group for ATM Video Coding
Title : Liaison statement to SGXVIII on VBR video coding advantage vs UPC time constant (for action)

The liaison statement from SGXVIII on traffic control and resource management (WPXVIII/8; issued in June 1992) indicated that the traffic parameter for the average is likely to be defined in terms of a reference algorithm as currently done for the peak rate in I.371. The Experts Group is greatly concerned with the time constant of the reference algorithm. If it is short in the order of e.g. 1 ms, the coder should regulate the coding rate much more tightly than the current CBR system where a transmission buffer of several tens of ms is used.

This statement reports a hardware experiment on the relationship between the advantage of VBR video coding and UPC time constant. The average rate is controlled by a leaky bucket with its time constant varied from zero to thirty seconds.

As is more fully described in Annex, we conclude from the experiment that:

1. concerning the two possible advantages of VBR coding, namely,

   1) realization of constant picture quality, and
   2) reduction of end-to-end delay by eliminating encoder output buffer,

   the first advantage increases only gradually and there is no definite saturation point as the UPC time constant increases up to as large as 30 seconds,

2. the second advantage can be obtained with relatively short UPC time constant and that there is no significant performance difference with the UPC time constant between 0.1 second to 1 second.

As part of SGXVIII's ongoing studies of UPC techniques, the SGXV Experts Group seeks reaction to the possibility of average rate measurement over a period of 10 seconds or more.

END

2. Experiment Parameters

- Coding Algorithm
  - H.261
- Picture Format and Picture Sequence Length
  - CIF and 10 minutes (18,000 frames)
- UPC method
  - Peak rate control: 6Mbps
  - Average rate control: 1.5Mbps with Leaky Bucket Control
  - Bucket Size: max 24bit, 16.38M Octet
  - Max duration for Peak rate: 30 sec (=16.38M Octet x 8 / (6Mbps-1.5Mbps) )
- Coding parameters control method
  - VBR mode (if Leaky Bucket Occupancy $\leq$ 90% of Leaky Bucket Size) $\Longrightarrow$ Constant Quantizer Stepsize and Constant Picture Quality.
  - CBR mode (otherwise)

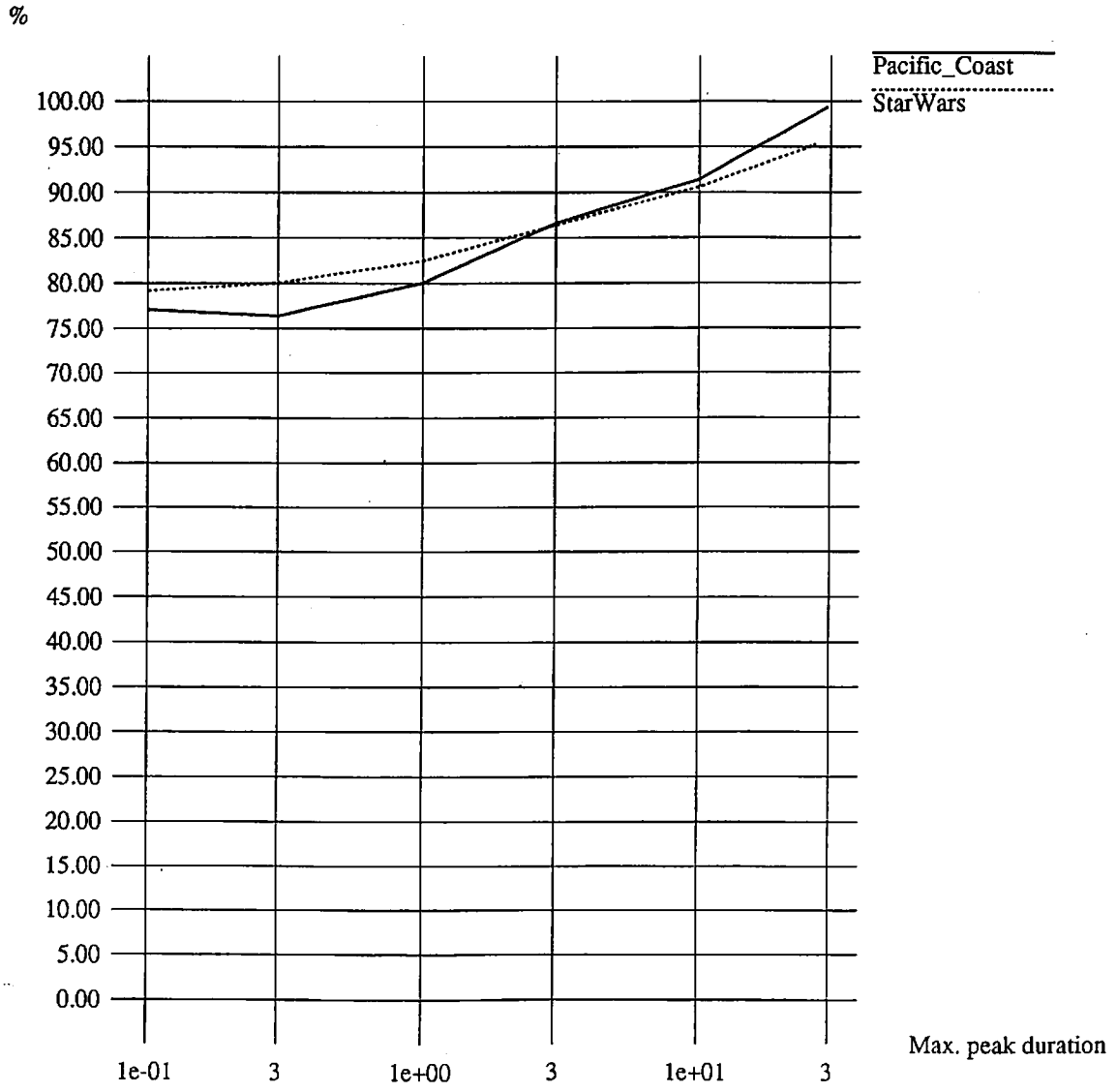


Figure 3: Percentage of frames coded by VBR vs. Leaky Bucket Size.

# Liaison Statement to SGXVIII on H.320 Terminal Support

Source: SGXV Experts Group for ATM Video Coding
Title : Response to the liaison statement from SGXVIII on support of H.320 terminals in B-ISDN (for action)

SGXV Experts Group for ATM Video Coding reviewed the SGXVIII's liaison statement titled "Considerations on support of H.320 in B-ISDN (Question to SGXV ATM Video Coding Experts Group, June 1992)" at our meeting in July 1992. We appreciate SGXVIII's recognition of the problem we raised in our previous liaison statement (dated August 23, 1991). The question at that time was as follows;

> "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.?"

Your statement is describing the nature of the problem, but once a cell loss happens, the problem is more serious as detailed in Annex. We agree to your summary;

i) for H.320 terminals cell loss correction capability may be mandatory depending on network performances;
ii) no capability is currently defined in Rec. I.363 for interactive low bit rate signals.

Considering that existing H.320 terminals have been designed without expecting any cell loss, the solution must be prepared inside the AAL-SAP. If there is no practical solution, the network performance for N-ISDN circuit emulation should be such as providing sufficiently long mean time between two cell losses.

END

ANNEX to Liaison Satement to SGXVIII on H.320 Terminal Support

The liaison states:

> 'Because inter-frame coding is highly used in H.261 coders, a proper recovery of the video signal may take some picture durations (maximum 132, ie 4.4 s, according to Rec H.261 para 3.4) until forced updating will "clean up" the picture.'

This statement is untrue in several respects and the real situation is more serious.

1. H.261 does indeed mention the number 132 but this is not 33 millisecond picture durations. It refers to the number of times a macroblock is updated and therefore also depends on the coded picture rate which may be fractions of 30 Hz. This makes the recovery time proportionally longer than the claimed 4.4 seconds. For example the figure for a low bit rate coder working at 7.5 pictures per second would be 17.6 seconds.

2. The point above assumes that coders refresh every part of the image at least once every 132 coded pictures. Many coders do this, but H.261 does not demand this. H.261 refers to the number of times a macroblock is updated. It is possible to maintain a separate counter for every macroblock of the image and update this counter when a macroblock is updated with information transmitted about it. With this method the refresh for stationary parts of the image will be considerably longer. It is conceivable that part of the scene will change, data be transmitted about it and be corrupted by cell loss, and because that part of the scene never changes again, the 132 count is never reached and the errored image at the decoder never cleaned up. While this may be unusual it should be mentioned that at least one product implements the refresh mechanism in this way and is perfectly valid.

   H.261 permits motion compensation to be employed and all known products incorporate this to some degree as it reduces the bit rate to about one half for equivalent quality. A consequence of motion compensation is that errors in one part of the decoded image can be moved to an adjacent part. Thus it is possible that an area of the image which has just been "cleaned up" by the forced updating will immediately be corrupted again by motion compensated prediction from a neighbouring corrupt region which has not yet been "cleaned up". It is entirely possible that certain combinations of refresh pattern and motion in the scene will defeat the "clean up" mechanism for extended periods.

The above three points mean that the 4.4 seconds mentioned in the liaison from SGXVIII is extremely misleading. In practical cases corrupted regions will remain for significantly longer periods. In theory the period is infinitely long. In practice there is high probability that 30 seconds or more will be encountered frequently.

END

**Proposed terms of reference**
**of**
**Experts Group for Very Low Bitrate Visual Telephony**

The terms of reference for the short term standardization are as follows;

1) to study video coding algorithm derived from existing standards such as H.261 applicable to several kbit/s and above,

2) to study speech coding at low bit rates around several kbit/s and above,

3) to study multiplexing methods (bit multiplexing and packet technique) for audio, video and other auxiliary signals,

4) to study methods for error correction and/or other error resilience,

5) to study modulation and demodulation methods to transmit the multiplexed audiovisual signal on PSTN, low bandwidth telecommunication networks, and/or mobile environments

6) and then to draft a Recommendation for the visual telephone terminal by the frist meeting of Study Group XV (September 1993) if required.

It is suggested to proceed as follows;

1) not to develop a new specific ISDN teleservice because of the severe impact on the network,

2) interworking between new very low bit rate video telephones and ISDN terminals is important, but to achieve it without any modifications of existing standard H.320,

3) not to go below 9.6 kbit/s for the total bit rate of audio and video from service quality consideration,

4) to use existing or emerging CCITT standardized modems.

Since it is recognized that the long term study for very low bit rate audiovisual communications is essential for CCITT, the group is also charged with recommending WPXV/1 of the following;

1) potential audiovisual applications at very low bit rates,

2) long term study plan (for the CCITT study period 1993-1996 or beyond) for audiovisual applications at very low bit rates (this work plan is expected by the end of 1993),

3) work method to collaborate with other standardization groups, particularly ISO/IEC JTC1/SC29/WG11.

END