SOURCE: Australia

TITLE: Response to Integrated Video Services (IVS) Baseline Document

PURPOSE: Proposal

**Abstract**

The IVS Baseline Document provides a vehicle for co-ordination of video services activity for the B-ISDN. Since the Experts Group was specifically established to look at the coding issues for video on the B-ISDN, it is appropriate that the group establish a significant role in the evolution of this document. Formal endorsement is recommended, and some text is suggested to offer for inclusion in the document.

## 1. Introduction

In its Nov./Dec. 1990 meeting in Matsuyama, CCITT SGXVIII initiated an Integrated Video Services (IVS) baseline document as an aid to co-ordination of the activities of the several standards groups actively working on video service issues relevant to the B-ISDN, and as a means of ensuring consistency with the directions of the B-ISDN. The IVS Baseline Document is intended to contain a summary form of the important issues concerning video services provision on the B-ISDN, and be jointly owned by the various contributing groups.

Australia believes that the CCITT SGXV ATM Video Coding Experts Group, which was specifically established to look at a range of video services on the B-ISDN, should assume a high profile in the evolution of this document, and should take advantage of the mechanism for co-ordination which it offers. The initiative has been welcomed by WPXV/1 and intention to contribute has been advised (see AVC-27), but much of the valuable input will come from the Experts Group.

Australia therefore proposes that the Experts Group should take two steps at the current meeting to establish a significant role. It should:

- formally endorse the IVS Baseline Document at the Experts Group level;

and  - contribute text to the document.

Two suggested areas for contribution, with some proposed text, are given below.

## 2. Video Service Interworking.

The initial text offered by SGXVIII on coding issues relevant to interworking is brief and its discussion of layered coding lacks perspective of alternative means of providing service interworking. It would be appropriate for the Experts Group to contribute in this area, to clarify the options for coding and indicate where our activity is leading.

As a basis for further discussion, the following contribution to the IVS baseline document is offered for inclusion in an appropriate liaison document:

> The CCITT SGXV Experts Group on Video Coding for ATM Networks 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.

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 is 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, a suitable family of picture formats requires definition. Such a family is under investigation and it is proposed to provide suitable definitions for inclusion in the IVS Baseline Document to permit co-ordination on this important issue, of common interest to many groups, at an early stage of the definition of video services for the B-ISDN.

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The above text is intended to present the discussion issues from AVC-35 without the conclusions (since the Group has not had the opportunity to discuss it). It may be appropriate to extend the above text or include an appropriate form of Table AVC-35/1 depending on the consensus achieved at the meeting.

## 3. Network Issues

The IVS Baseline Document provides an ideal forum to raise issues concerning the B-ISDN Network about which the Experts Group requires information. Little information was able to be provided by SGXVIII in response to the Experts Group liaison statement requesting parameters for the network (see AVC-24). The IVS Baseline Document provides a valuable mechanism whereby the parameters requiring definition can be notified and be a constant reminder to the network people contributing to the document.

The following additional contribution to the IVS Baseline Document is therefore also offered. Note that much of this text is based on the liaison to SGXVIII from the first meeting.

The CCITT SGXV Experts Group on Video Coding for ATM Networks 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 (and on different virtual paths?) need to be defined. Will the cell loss ratio be guaranteed at all? Studies on appropriate video coding methods are expected to determine whether such a guarantee will be necessary for video services.

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 behaviour

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 if multiple consecutive lost cells must be detected and corrected. Cell loss burst behaviour may be modelled 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 lost).

Open questions remaining are:

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

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

## Use of CLP bit

Open questions:

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

- When will the service provider set this bit? Could the CLP be changed by a service provider after the user has set it?

- 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.

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.?

## 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, with possible savings in complexity and cost, as well as greater flexibility. 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 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.

### 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.

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 receive 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.

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## 4. Conclusion

The IVS Baseline Document offers an important forum for the Experts Group to maintain co-ordination with the other groups active in video service standardisation for the B-ISDN and the directions of the network upon which we are highly dependent. The Experts Group should establish itself early as having a key role in the evolution of the IVS Baseline Document. The Group should both endorse the role of the document and offer substantial textual contributions to it. Two suggestions of areas that would seem appropriate have been offered in this Document.