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Experts Group for ATM Video Coding

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TITLE: The Impact of the Network on Video Coding

PURPOSE: Information

**Abstract**

Traditionally, source and channel coding for video signals have been separated functions. This has been possible because all bits transmitted over a circuit switched network are assumed to be subject to the same processes and probabilities of error. ATM transport on the B-ISDN represents a fundamentally different environment, and the characteristics of the network must be considered in the design of video coding algorithms if optimum performance is to be obtained. It is therefore essential that the characteristics of ATM transport be taken into account from the start in the development of a video coding system for the B-ISDN.

## 1. Introduction

In defining a codec suitable for the B-ISDN, it is not possible to divorce the consideration of the network characteristics from the development of the coding algorithm. The characteristics which need to be considered are:

- cell loss;
- the availability of two different cell priorities;
- the availability of variable bit rate channels;
- the capability of the network to accept significant bandwidth changes when different operational modes are required.

Each of these has an impact on the fundamental coding structure.

## 2. Cell loss

The need to cope with cell loss will influence the structure of the coded bit stream (to get rapid resynchronisation) and also the exploitation of redundancy (e.g. more controlled use of recursive prediction). Coding for cell loss tolerance therefore requires deeper consideration than simply the means by which the generated bits are packaged for transmission.

## 3. Cell Loss Priority

The availability of two cell priorities which will have different cell loss characteristics means that bits transmitted over the network are not treated equally. This is a fundamental departure from the assumptions which allow independent development of source and channel coding.

Optimum performance of a video coding system in the ATM environment therefore demands consideration of what information should be transported in the different cell loss priority classes, and is the reason why layered coding is under consideration as a means of cell loss protection. There is a fundamental impact of the network characteristics on the basic coding architecture.

## 4. Variable Rate Coding

Variable bit rate coding appears to be more efficient than constant bit rate coding for services operating at low-medium rates (relative to the channel capacity) and therefore must be a part of any coder developed for the B-ISDN. (Note that CBR operation is a special case of VBR, so operation in this mode is not precluded by a requirement for VBR capability.) Rate control, whether through buffering and feedback in a constant rate system or perhaps some peak rate

limit in a VBR system, is a basic element that impacts on the reproduced picture quality. VBR coding and its impact on the coding architecture must be taken into account throughout the codec standardisation process.

## 5. Flexible Bandwidth Allocation

There is potential for the coding system to exploit the flexible bandwidth characteristic of the B-ISDN, to reduce the average rate of transmission. For example, the coding system can be designed to allow a reduction of picture resolution and output data rate, prior to or during a call, according to size of display window at the receiver. This has the potential of significantly increasing the efficiency of transmission in continuous-presence multi-point systems and desktop multi-media video systems where reconstructed video is typically displayed on a portion of a screen.

## 6. Conclusion

The transmission environment in the B-ISDN is fundamentally different to that of traditional circuit-switched networks, in which independent consideration of source and channel coding has been possible. During the development of a video coding system for the B-ISDN, it is essential that the network charcteristics be taken into account. Any plan to consider how the resulting bit stream might be carried after the coder has been designed, is certain to provide suboptimal performance. This will, in turn, encourage use of non-standard coding systems because of the benefits in cost and performance that could be achieved.

It is recognised that, in aiming for a coding scheme optimised for the B-ISDN, co-ordination with other groups will be important to maximise performance across interconnected transmission systems.