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

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Subject: Non-compatible vs Simulcast vs Compatible (Experiment G.3)

Source: Bellcore

Purpose: Information

The spatial scalability and compatibility experiment G.3 documented in Appendix G. of TM1 was performed. This experiment allows the encoding of two spatial resolution layers, HHR (Half Horizontal Resolution) frames and CCIR-601 frame-structured pictures at a total bit rate of 4 Mb/s. The encoding of each layer is summarized as follows:

HHR frames are created by decimating the CCIR-601 4:2:0 pictures into half horizontal resolution with 352x480 pels for Y and 176x240 pels for both Cr and Cb. These HHR frames are MPEG-1 coded at 2 Mb/s with TM1 rate-control. Motion estimation is performed with full search at +/-7.5 pels/frame horizontally and +/-15.5 pels/frame vertically.

The CCIR-601 4:2:0 pictures are coded by a frame-sequence frame-structured TM1 at 2 Mb/s with adaptive frame/field prediction (FAMC and dual-field prediction are not used) and adaptive frame/field DCT coding. Motion estimation is performed with full search at +/-15.5 pels/frame horizontally and vertically. The decoded HHR frames are horizontally upsampled and compared with the best temporal prediction on macroblock basis and the selection criterion is the least MSE.

This experiment is performed with N=15 and M=3 on Flower Garden and Mobile & Calendar. The results are summarized in the following Table and will be presented in an accompanying tape.

scheme	Flower Garden	Mobile & Calendar
Non-compatible (4 Mb/s)	29.38 dB	28 dB
Simulcast (2 Mb/s)	25.74 dB	24.95 dB
Compatible (total 4 Mb/s)	27.79 dB	26.23 dB
spatial prediction (%)	(100:47.33:10.73)	(99.86:35.74:8.09)
HHR (2 Mb/s)	25.49 dB	25.68 dB

The non-compatible scheme is the encoding of the CCIR-601 layer without spatial prediction from the HHR layer. The simulcast scheme is the non-compatible scheme coded at 2 Mb/s. The compatible scheme is the two-layered method described. The spatial prediction percentile represents the percentage of CCIR-601 macroblocks being spatially predicted from the HHR layer for the I-, P-, and B- pictures.

Remarks:

- The compatible scheme is preferred over simulcast. It has an average SNR of 2.05 dB better than simulcast on Flower Garden, and 1.28 dB better than simulcast on Mobile & Calendar.
- The perceptual quality of the compatible scheme is not as far off from the non-compatible scheme as it might appear on the SNRs.
- The spatial prediction mode is heavily used by the compatible scheme in coding I-pictures. Some modification must be made in the selection criterion to make the spatial prediction mode more effective for coding P- and B- pictures.
- The perceptual comparison of the simulcast quality and the HHR layer shows a greater difference than it appears on the SNR. The simulcast quality may be improved with FAMC.