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

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SOURCE : UK
TITLE : Cell Level Statistics for a Two-Layer Coding Scheme.
PURPOSE : Information

## 1. Introduction

So far statistics have been gathered on a picture by picture basis for the bit rates.

Presented here are statistics gathered on a picture basis, group of blocks (GOB) basis and cell basis.

## 2. Method

A 2-layer coding model was used (see appendix). The number of bits generated per 8 by 8 picture block was monitored in the second layer.

For the cell level statistics when sufficient bits had been generated to fill a cell then the time interval over which the cell was filled was recorded. This time interval is in discrete steps of block periods (bits are accumulated on a block by block basis).

For the GOB level statistics the number of cells generated per GOB was recorded and at the picture level the number of cells generated per picture.

## 3. Results

Results for two sequences have been obtained:

1. Jack in the Box at a picture rate of 30 pictures/sec (144 pictures). The base layer bit rate was 256kbits/s with one inter GOB update per picture. The VBR quantizer stepsize was 8.

2. Salesman at a picture rate of 10 pictures/sec (149 pictures). The base layer bit rate was 128kbits/s with one inter GOB update per picture. The VBR quantizer stepsize was 8.

The results are summarized in table 1.

| | Jack in the Box | | | Salesman | | |
|---|---|---|---|---|---|---|
| | PIC kbits/s | GOB kbits/s | CELL kbits/s | PIC kbits/s | GOB kbits/s | CELL kbits/s |
| *MEAN* | 313 | 313 | 313 | 833 | 833 | 833 |
| *MINIMUM* | 0 | 0 | 3841 | 334 | 0 | 35 |
| *PEAK* | 1670 | 4147 | 27372 | 1060 | 1843 | 9124 |
| *P/M* | 5.344 | 13.268 | 87.572 | 1.27 | 2.21 | 10.95 |
| *st dev* | 432 | 611 | 4040 | 110 | 1364 | |
| *coef var* | 1.383 | 1.956 | 12.926 | 0.13 | 1.637 | |

Table 1: Bitrate Statistics at Picture, GOB and Cell Level

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There are two interesting things to note here,

1. Even for a videophone type sequence (Salesman) the source can be bursty at the cell level.

2. A relatively small buffer makes a significant difference to the shape of the source (compare GOB level with cell level statistics).

Conclusion

Network loading figures based on picture level statistics could be significantly different when based on shorter time periods.

Appendix

Two-Layer Coding Model

## A1. Introduction

This section outlines some additions made to reference model 8 to model a two-layer coding scheme. The additional modules required are shown in the shaded areas.

## A2. Two Layer Coding

The two-layer coding scheme consists of a base layer which is H.261 compatible and a second layer that codes the difference between the base layers DCT coefficients and their quantized values, figure 1. The resulting differences are further quantized with a fixed quantizer step size at present and VLC coded.

### A2.1 Block Addressing and VLC Coding

The problem of cell loss has an impact on the block addressing and VLC coding scheme. Purely differential block addressing is unacceptable as lost cells would cause the decoder to loose track.

The most efficient way to address blocks is for the first block in a cell to be absolute and subsequent blocks in the same cell to be differential. The first block address must be preceded by a unique synchronization code.

In the event of a lost cell then the decoder can search through the next cell until it detects the synchronization word and the new absolute block address.

By dropping the Group and Macro Block structure and addressing blocks on an individual basis, the absolute block addressing becomes more efficient, requiring only 12 bits to uniquely define blocks (there are 2376 blocks in a CIF picture). The relative block addressing within packets can then also continue over GOB boundaries without any problems. Figure 2 shows an example bit stream within a cell.

| One Cell | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 8 bits | 5 bits | | 12 bits | 12 bits | | 24 bits max | | | |
| SN | TR | VLC Data | Sync Code | ABA | VLC Data | DBA | VLC Data | DBA | VLC Data |

SN Cell Number TR Temporal Reference
ABA Absolute Block Address DBA Differential Block Address

Figure 2: Cell Structure

Note that each cell starts with a sequence number followed by a temporal reference. This is to detect cell loss and to sync the data in the cell with the base layer.

### A2.2 Quantizer

The coefficients are in a zigzag scan format and a variable threshold is applied independently of the quantization strategy to increase the number of zero coefficients. This is as defined in RM8. The quantizer has a fixed step size of 8.

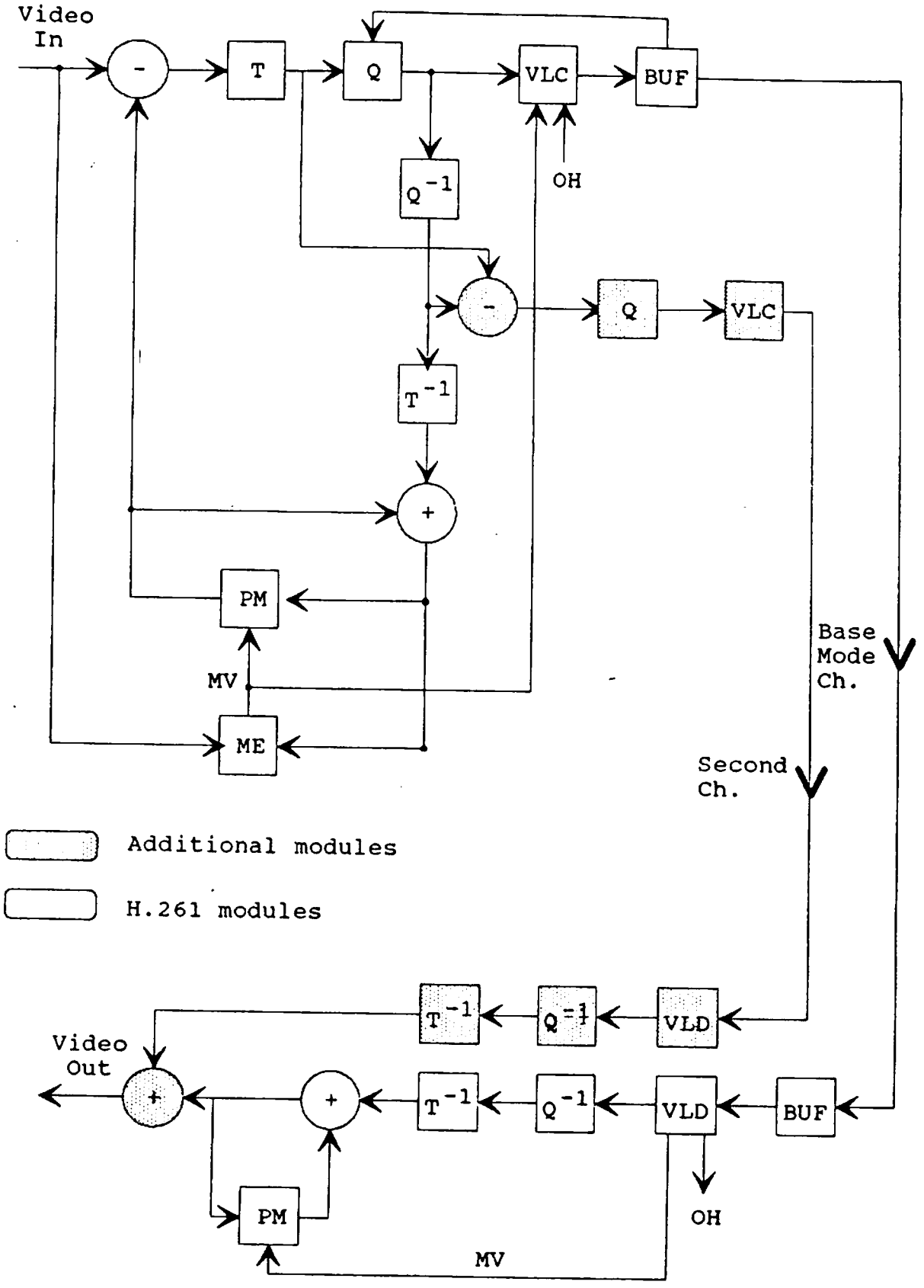


Figure 1: Two-layer coding model