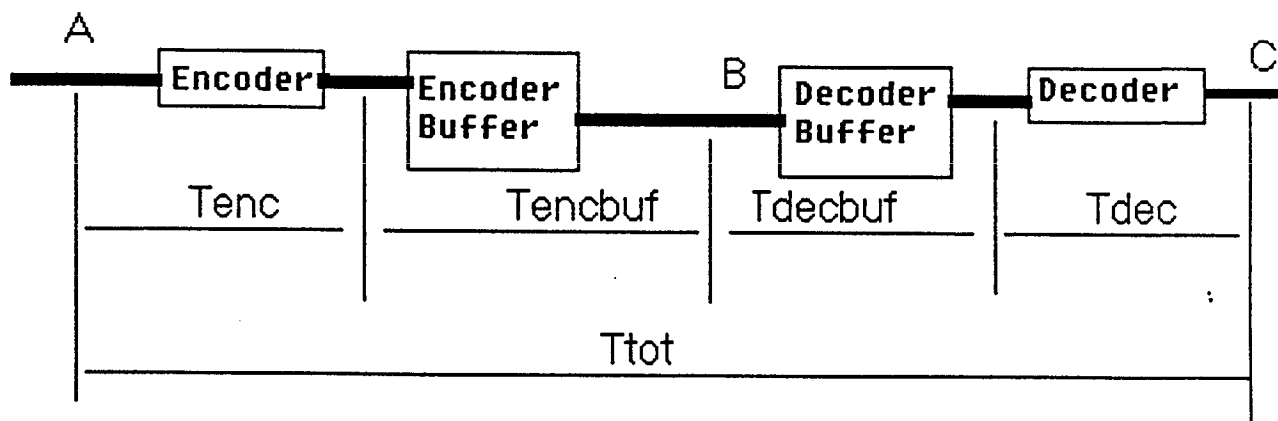


Title: H.261 VIDEO CODEC DELAY

Source: BT

For ease of understanding, first consider a hypothetical real time (ie non-DSP) video codec design as shown below.



The total codec delay T_{tot} can be considered as a series of smaller delays T_{enc} , T_{encbuf} , T_{decbuf} and T_{dec} . Where:

T_{enc} is the encoder delay from the video input to the buffer input

T_{encbuf} is the delay in the encoder buffer

T_{decbuf} is the delay in the decoder buffer

T_{dec} is the decoder delay from the output of the decoder buffer to the video output

It is possible to quantify the various delays in the codec by observing only three points shown as A, B and C in the above diagram. Point A is the video input, point B is the channel output and point C is the video output from the decoder.

The encoder delay, T_{enc} , can be determined by sourcing a series of black pictures into the codec at point A for say five seconds followed by a series of white pictures. During the period of black pictures the encoder buffer will be empty and thus at the black to white transition T_{enc} will equal zero. By measuring the time from the beginning of the black to white transition at point A to the time that the transition is coded at point B (ie the first picture containing a DC value of 239), T_{enc} can be measured.

The similar technique can be used to determine the decoder delay T_{dec} . However, to avoid inclusion in the calculation the time taken for the transmission of the first white picture, the measurement should be made from the end of the first white picture to the time that the first white picture is displayed.

If we attempt to measure the encoder buffer delay or decoder buffer delay independantly then clearly this will vary dependant on buffer content. However, at a constant frame rate the encoder plus the decoder delay will equal a constant. If we consider the time delay across the buffer to the beginning of each codec frame then the problem of the time taken for the bits in the frame to be transmitted can be overcome. The maximum allowable delay on picture start codes has previously been determined by another parameter in the specification for picture start code jitter. If we assume that the maximum allowable picture start code jitter is 2 CIF frame periods then is not possible for the buffers to introduce a variable delay of more than 2 CIF frame periods to the start of each picture. This is true for all codec designs and therefore need not be specified further. Therefore from a specification point of view the maximum delay of a codec can be constrained by stating only Tenc maximum and Tdec maximum because the other parts of the specification cover the worse case buffer delays.

As described above it is possible to easily determine by measurement the delays Tenc and Tdec.

AUDIO DELAY

To allow audio delay compatibility and maintain lip synchronisation manufacturers will need to delay their audio by the period Tenc plus one CIF frame period at the encoder and Tdec plus one CIF frame period at a decoder.