Audio Transmission

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Exercise

Multimedia Technology,

Tutorial 4, section 2

Audio Transmission

Assume we encode audio with a maximum frequency of 20 kHz using the minimum sampling rate according to Nyquist, with 16 bits per sample.

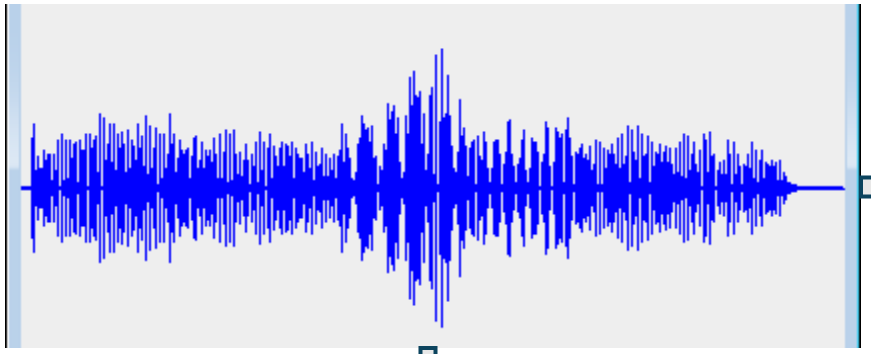
For transmitting the audio in each packet, in addition to the above encoded signal, we also include a lower-quality encoding of the previous packet. This lower-quality encoding is obtained by filtering the signal so that the maximum frequency is 5 kHz, and sampling is performed at the minimum rate according to Nyquist, with 8 bits per sample.

What is the percentage overhead added by the lower-quality encoding?

What is the maximum size of the total packet (in bytes) that can be used so that the packet generation delay does not exceed 10 ms?

Calculate the delay from the moment the first sample of a packet is produced until the packet is sent, ignoring the overhead caused by protocol headers.

Audio with maximum frequency of 20KHz

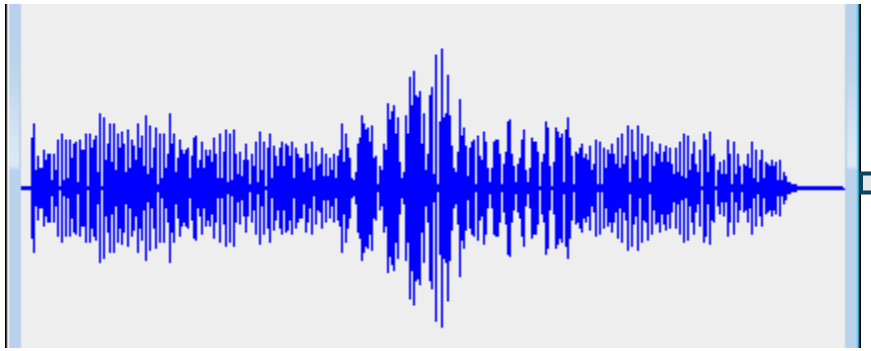


A to D
2 * 20KHz = 40KHz
16 bit

40Kbyte * 16bit = 640Kbps

640 + 80 = 720Kbps

Audio with maximum frequency of 5KHz



A to D
2 * 5KHz = 10KHz
8 bit

10Kbyte * 8bit = 80Kbps

What is the percentage overhead added by the lower-quality encoding?

80Kbps / 640 Kbps = 1 / 8 = 12.5 %

Maximum Packet Size for 10 ms Delay

What is the maximum size of the total packet (in bytes) that can be used so that the packet generation delay does not exceed 10 ms?

Note: Calculate the delay from the moment the first sample of a packet is produced until the packet is sent, ignoring overhead caused by protocol headers.

We need to calculate how many bytes are generated in 10 ms for each stream.

- The high-quality stream produces 640 Kb/s or 640 (Kbit/sec)/ 8 (bit/Byte) = 80 KByte/sec.

  In 10 ms or 0.01 sec, it produces: 0.01 * 80 Kbyte = 800 Byte.

- The low-quality stream produces 80 Kb/s or 80 (Kbit/sec)/ 8 (bit/Byte) = 10 KByte/sec.

  In 10 ms or 0.01 sec, it produces: 0.01 * 10 Kbyte = 100 Byte.

The total size of the packet created in 10 ms is: 800 + 100 = 900 Byte.