

Tutorial 10 - Updated Solution. 10 October 2011

Question 4 – A clearer description.

An audio streaming server has a maximum one-way network delay distance of 50 ms with a media player.

Assume that the audio is coded at 1 Mbps (the rate at which the player consumes data). Assume that the streaming server has a maximum output data rate of 10 Mbps.

If the media player has a 1MB buffer, what can you say about the position of the low-water mark and the high-water mark?

Answer:

1Mbyte = 1,048,576 bytes.

For this question, **low-water mark** is the latest time (lowest buffer contents) at which the media player must be requested to recommence data transmission so that the player does not run out of data before new data arrives.

(The low-water mark term is also used to describe the fullness of the buffer when the player first starts, but this depends of things like jitter, that are not defined here, so we'll use the above definition).

When a “play command” is issued, it will take 50ms for the command to reach the server, plus 50 ms for the data to start arriving, so the buffer must have enough data to play 100ms worth of audio.

If the audio is 1Mbps, this means 100,000 bits or 12500bytes.

High water mark is when the player signals “pause” so that the buffer doesn't overflow. It will take 50 ms for pause to reach the server then another 50ms for the last of the data to reach the player. During this time, $100\text{ms} \times 10\text{Mbps} = 1,000,000 \text{ bits} = 125,000 \text{ bytes}$ could arrive. During this 100ms, the player will potentially be consuming 12,500Bytes. However if the user hits pause just after the high water mark is reached, then we will need the full 125,000 bytes of buffer space headroom. So we should set the high water mark at $1\text{MB} - 125,000\text{B} = 923,576\text{B}$.

So low water mark depends on the “play-out” speed from the buffer, and the high-water mark depends on the server data-rate into the buffer.

So the low water mark should be at 12,500 bytes or higher, and the high water mark should equal to or lower than 923,576 bytes (1MB-125,000B)