

METHOD AND SYSTEM FOR CONTROLLING DATA PACKET TRANSMISSIONS OVER LOSSY PROTOCOLS

Field of the invention

The present invention relates to methods and systems for digital data transmission. In particular the invention relates to methods and systems for controlling the bitrate of data packet transmissions over lossy protocols.

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Background of the invention

It is known that in digital transmission it is possible to transmit data with different bitrate.

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As an example, Internet provides users the possibility to watch videos stored on web servers. Since different users can have different type of connections to the network (e.g. wireless connection or cable connection or fibre optic connection), the web servers allow users to select the video quality, i.e. the bitrate, they can support. The higher the bitrate, the higher is the quality of the video, but the higher is the possibility of error transmission.

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If data are transmitted with a TCP (Transmission Control Protocol) protocol, in case of error the data are sent again and the user only perceives a delay in the transmission or a not correct streaming.

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If data are transmitted with an UDP (User Datagram Protocol) protocol, error transmission can be fatal since the receiver will not be able to reconstruct the correct order of the data stream.

Nowadays selection of the bitrate is accomplished with a traditional trial and error approach, wherein the user tries to setup communication with a first bitrate and then tries increasing or decreasing the bitrate until he finds the best compromise between quality and transmission errors.

Objects and summary of the invention

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An embodiment ~~It is an object of the present invention to provide~~ a method for transmitting data packets that allows trying to increase the bitrate with a reduced risk to lose data. Another embodiment ~~It is a further object of the present invention further to provide~~ a method for transmitting data packets that allows automatic selection of the bitrate.

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These and further objects are achieved by means of a system and a method for

transmitting data incorporating the features of the annexed claims, which form integral part of the present description.

In a first aspect of the present invention, there is provided a method for data packets transmission. The method comprises the steps of transmitting a first group of data packets with a first bitrate, the data packets of said first group comprising a first payload having a specified number of bits, checking quality of transmission of said first group of data packets, if transmission quality of said first group of data packets is above a first threshold, transmitting a second group of data packets with a second bitrate, the data packets in said second group comprising said first payload and additional control data allowing a receiver to check consistency of the delivered second group of data packets, whereby said second bitrate is higher than said first bitrate; checking quality of transmission of said second group of data packets, if transmission quality of said second group of data packets is above a second threshold, transmitting a third group of data packets with said second bitrate, the data packets in said third group comprising a second payload comprising more bits than said first payload, thereby increasing the bitrate of said second payload.

~~In one aspect of the invention a first group of data packets is transmitted with a first bitrate. This first group of data packets comprises a first payload. Quality of transmission of said first group of data packets is checked and, if it is above a first threshold, a second group of data packets is transmitted with a second bitrate higher than the first bitrate. The second group of data packets comprises a second payload, and additional control data allowing a receiver to check consistency of the delivered payload.~~

This method therefore provides for a stage wherein, after having checked that transmission works with a given bitrate, it is possible to try increasing the bitrate by transmitting data with a higher bitrate, whereby bitrate is increased by adding control data (instead of payload) to the group of data packets to be transmitted. In this way if the transmission with higher bitrate should fail, it is possible to recover data of the packet by using the added control data, if transmission with the higher bitrate works, then it is possible to maintain the increased bitrate and

increase the information content, in particular the payload of the next group of data packets.

It is therefore clear that this method allows increasing the bitrate without losing packets, which is very important in certain transmission protocol, like UDP protocol.

In one preferred embodiment, selection of the bitrate is accomplished in an automatic and dynamic way by evaluating the transmission quality based on objective data, like the number of transmission errors or other parameters like a packet loss rate that can be calculated by the receiver and preferably provided to the transmitter. In this way, if the channel quality changes in time, the method allows automatic modification of the bitrate.

In one embodiment, the decision to increase the bitrate is taken by comparing the quality of transmission (or a parameter linked to it) with a threshold that depends on the bitrate; in this way it is possible to put stricter conditions on quality as the bitrate increases.

In a second aspect of the present invention, there is provided a transmitter for transmitting data packets to a receiver. The transmitter comprises: a transmitter unit for transmitting a first group of data packets with a first bitrate, the data packets of said first group comprising a first payload having a specified number of bits, and a receiver unit for receiving information about the quality of transmission of said first group of data packets, the transmitter unit being adapted to generate and transmit a second group of data packets with a second bitrate if transmission quality of said first group of data packets is above a first threshold, the data packets in said second group comprising said first payload and additional control data allowing a receiver to check consistency of the delivered second group of data packets, whereby said second bitrate is higher than said first bitrate; the receiver unit further being adapted to receive information about the quality of transmission of said second group of data packets, and the transmitter unit further being adapted to transmit a third group of data packets with said second bitrate, if the transmission quality of said second group of data packets is above a second threshold, the data packets in

said third group comprising a second payload comprising more bits than said first payload, thereby increasing the bitrate of said second payload.

In a third aspect of the present invention, there is provided a receiver for receiving data packets from a transmitter. The receiver comprises: a receiver unit for receiving a first group of data packets with a first bitrate, the data packets of said first group comprising a first payload having a specified number of bits, and a transmitter unit for transmitting information about the quality of transmission of said first group of data packets, the receiver unit being adapted to receive a second group of data packets with a second bitrate if transmission quality of said first group of data packets is above a first threshold, the data packets in said second group comprising said first payload and additional control data allowing the receiver to check consistency of the delivered second group of data packets, whereby said second bitrate is higher than said first bitrate; the transmitter unit further being adapted to transmit information about the quality of transmission of said second group of data packets, and the receiver unit further being adapted to receive a third group of data packets with said second bitrate, if the transmission quality of said second group of data packets is above a second threshold, the data packets in said third group comprising a second payload comprising more bits than said first payload, thereby increasing the bitrate of said second payload.

CLAIMS

1. Method for data packets transmission, comprising the steps of

- transmitting ~~(203)~~ a first group of data packets with a first bitrate, the data packets of said first group comprising a first payload ~~(P)~~ having a specified number of bits,

- checking ~~(205)~~ quality of transmission of said first group of data packets,

- if transmission quality of said first group of data packets is above a first threshold, transmitting ~~(208-209)~~ a second group of data packets with a second bitrate, the data packets in said second group comprising said first payload and additional control data ~~(C1)~~ allowing a receiver to check consistency of the delivered second group of data packets, whereby said second bitrate is higher than said first bitrate;

- checking ~~(211)~~ quality of transmission of said second group of data packets,

- if transmission quality of said second group of data packets is above a second threshold, transmitting a third group of data packets with said second bitrate, the data packets in said third group comprising a second payload comprising more bits than said first payload, thereby increasing the bitrate of said second payload.

2. Method according to claim 1, comprising the steps of

- checking ~~(211)~~ quality of transmission of said second group of data packets,

- if said transmission quality of said second group of data packets is below a second threshold, transmitting a fourth group of data packets with said first bitrate, said fourth group comprising a payload comprising the same number of bits of said first payload.

3. Method according to claim 1 or 2, further comprising the step of transmitting ~~(205-206)~~ a group of data packets with a third bitrate if transmission quality of said first group of data packets is below a third threshold, said third bitrate being lower than said first bitrate.

4. Method according to claim 3, further comprising the step of transmitting ~~(205-203)~~ a group of data packets with said first bitrate if transmission quality of said first group of data packets is comprised between said first and said third threshold.

5. Method according to any of claims 1 to 4, wherein said first payload and said second payload have the same number of bits.

6. Method according to any of claims 1 to 5, wherein said additional control data are generated according to a FEC scheme.

7. Method according to any of claims 1 to 6, wherein said additional control data are used for coding a respective payload of a packet of said second group of data packets, whereby the receiver can check consistency of the delivered payload by decoding received packets.

8. Method according to any of claims 1 to 7, wherein said first bitrate depends on information generated by the receiver before starting of transmission.

9. Method according to any of claims 1 to 8, wherein said first group of data packets comprises data packets compressed with a compression bitrate, the bitrate at which the packets are transmitted being selected as the maximum between the maximum bitrate supported by the connection and the maximum compression bitrate of the data packets to be transmitted, if data packets have a variable compression bitrate, the transmission bitrate is selected as the average or the maximum compression bitrate.

10. Method according to any of claims 1 to 9, wherein quality of transmission is measured as the inverse of the number of transmission errors ~~(ϵ)~~.

11. Method according to any of claims 1 to 9, wherein data packets are classified based on a priority scheme and wherein quality of transmission is measured as the inverse of a packet loss rate defined as

$$R = \frac{a \cdot \sum_i Pl_{li} + b \cdot \sum_i Pl_{hi}}{a \cdot \sum_i Pl_i + b \cdot \sum_i Ph_i}$$

wherein R is the packet loss rate, Pl are packets with low priority, Ph are packets with high priority, Pl_l are low priority packets lost, Pl_h are high priority packets lost, a and b are constants with $b > a$.

12. Method according to any of claims 1 to 11, wherein said first threshold depends on the bitrate at which data packets are transmitted.

13. Method according to any of claims 1 to 12, wherein the receiver can generate a command to stop increasing of the bitrate, and wherein said second group of data packets are transmitted if transmission quality of said first group of data packets is above said first threshold and if the receiver has not provided a command to stop increasing of bit rate.

14. Transmitter for transmitting data packets to a receiver, the transmitter comprising:

- a transmitter unit for transmitting ~~(203)~~ a first group of data packets with a first bitrate, the data packets of said first group comprising a first payload ~~(P, P and C)~~ having a specified number of bits, and

- a receiver unit for receiving information about the quality of transmission of said first group of data packets,

- the transmitter unit being adapted to generate and transmit ~~(208-209)~~ a second group of data packets with a second bitrate if transmission quality of said first group of data packets is above a first threshold, the data packets in said second group comprising said first payload ~~(P, P and C)~~ and additional control data ~~(C1)~~ allowing a receiver to check consistency of the delivered second group of data packets, whereby said second bitrate is higher than said first bitrate;

- the receiver unit further being adapted to receive information about the quality of transmission of said second group of data packets, and

- the transmitter unit further being adapted to transmit a third group of data packets with said second bitrate, if the transmission quality of said second group of data packets is above a second threshold, the data packets in said third group

comprising a second payload comprising more bits than said first payload, thereby increasing the bitrate of said second payload.

5 15. Receiver for receiving data packets from a transmitter, the receiver comprising:

- a receiver unit for receiving a first group of data packets with a first bitrate, the data packets of said first group comprising a first payload-(P) having a specified number of bits, and

10 - a transmitter unit for transmitting information about the quality of transmission of said first group of data packets,

- the receiver unit being adapted to receive a second group of data packets with a second bitrate if transmission quality of said first group of data packets is above a first threshold, the data packets in said second group comprising said first payload-(P) and additional control data-(G1) allowing the receiver to check consistency of the delivered second group of data packets, whereby said second
15 bitrate is higher than said first bitrate;

- the transmitter unit further being adapted to transmit information about the quality of transmission of said second group of data packets, and

20 - the receiver unit further being adapted to receive a third group of data packets with said second bitrate, if the transmission quality of said second group of data packets is above a second threshold, the data packets in said third group comprising a second payload comprising more bits than said first payload, thereby increasing the bitrate of said second payload.

25 16. Transmitter as claimed in claim 14, wherein the transmitter is in the form of a computer server which is adapted to implement the method as claimed in any of the claims 1 to 13.

30 17. Receiver as claimed in claim 15, wherein the receiver is in the form of a client computer which is adapted to implement the method as claimed in any of the claims 1 to 13.