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TITLE

Measurement and Use of Streaming Data Quality Indicator

ABSTRACT

The present invention is a module within the operating system of a computing device calculating the data quality of an incoming media stream. The calculated measure of data quality is sent to the transmitting device. The transmitting device may use this information to adjust the characteristics of the data stream to reduce network load and/or improve data stream quality for the receiving party.

1. BACKGROUND

Problem or Opportunity

Computing networks, such as the internet, are becoming an increasingly popular medium for the transmission of audio and video data. When streaming audio and video data, it is important that the data reaches the receiving party promptly to ensure seamless playback for the receiver. However, periods of high network traffic can slow down packets of streaming data and create lengthy buffer times or interrupted data streams for the receiving party. On the other hand, during times of low network traffic, audio and video data streams may not take advantage of the available bandwidth. This results in less than optimal data quality for the receiving party. For the receiving party, problems with data quality are easily identified; however, it is difficult for the transmitting party to determine the quality of media stream being received. A system is needed to identify data quality problems in streaming media and adjust the data stream to address data quality issues.

Background Publications

Previous publications have attempted to address the problem of streaming data quality. However, the previous publications do not use a measure of data quality that is calculated by the receiving party.

US Patent Number 7251578 describes a “Method and system of measuring data quality” in a data processing stream. When data is transferred from one data processing system to

another, the data quality is measured before processing by the second data processing system. This method identifies erroneous data and prevents the processing of the erroneous data. This does not relate to the measurement of streaming media quality as experienced by the receiving party.

US Patent Number 6243761 describes a method for dynamically adjusting web based media content based on the condition of the network. Before delivering media content, a web page server analyzes the condition of the network path and adjusts properties of the media accordingly. This invention uses network quality, not received data quality to adjust media characteristics.

US Patent Number 7092382 describes a system for improving the quality of packet-oriented audio transmission. Packets of audio data are received by a computing machine. Information gathered from the packets, such as number of dropped packets, is used to adjust the audio playback by altering the sampling rate or modifying the duration of an audio signal. This invention does not calculate a comprehensive measure of received data quality and does not adjust data stream characteristics from the transmission side.

2. SUMMARY OF INVENTION

Invention Summary

In the present invention, an A/V Streamer module on a Streaming Device adjusts the characteristics of an outgoing data stream based on the quality of the stream as measured by the Receiving Device.

A Quality Measurement Algorithm on the Receiving Device uses metrics regarding the quality of the incoming data stream to calculate a single value indicating the data quality. For streaming data, uninterrupted playback is an essential component of data quality. To calculate data quality, a variety of metrics may be used including average buffer time, frequency of playback interruptions, or percentage of packets dropped. This data quality indicator is sent to the Streaming Device

The A/V Streamer uses the data quality indicator to adjust the outgoing media stream, with the goal of increasing the data quality for the Receiving Device. If the data quality indicator is below a predetermined threshold, the A/V Streamer adjusts the characteristics of the outgoing stream. A/V streamer may adjust a variety of parameters of the outgoing stream including the sampling rate, bit rate, resolution, or other parameters. If the data quality does not fall below the predetermined threshold, the stream is not adjusted.

Unique Concepts

The unique concept of the present invention is the measurement of the data quality of a media stream by the receiving device for use by the transmitting party.

3. DESCRIPTION OF THE INVENTION

Figure 1 depicts the system for Sampling Rate Adjustment.

The Streaming Device is a computing device such as a laptop, desktop computer or mobile device that is connected to a Network such that it is capable of streaming audio or video data.

The OS is an operating system, such as Linux, running on the Streaming Device and the Receiving Device. The OS manages interactions between hardware, software, and the user.

The Network Interface is the component of the OS that is responsible for managing all network communication.

The A/V Streamer is a module within the OS that manages the streaming of A/V Data and adjusts the sampling rate from the A/V Data based on Network conditions.

The A/V Data is high quality audio or video data intended for streaming across the Network, stored on the Streaming Device.

The Network is any network of computing devices, such as the internet, over which A/V Data can be streamed.

The Receiving Device is a computing device such as a laptop, desktop computer, or mobile device that is capable of receiving and playing streaming A/V Data.

The Quality Measurement Algorithm is an algorithm within the OS of the Receiving Device that measures the quality of the incoming media stream. The Quality Measurement Algorithm calculates a single value indicating the quality of data. The Quality Measurement Algorithm may consider metrics such as the average buffer time, average continuous playback time, fraction of dropped packets, or other information to calculate the quality of the data.

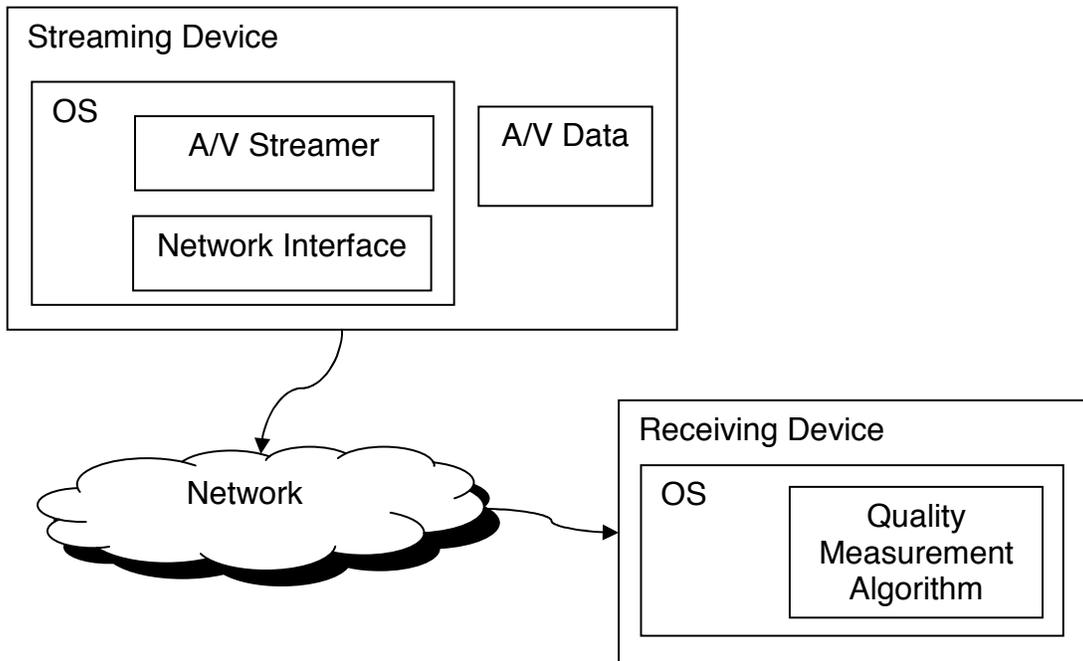


Figure 1. System for Sampling Rate Adjustment.

Figure 2 depicts the method for Sampling Rate Adjustment.

In step 1, the Streaming Device transmits a stream of A/V Data over the Network to a Receiving Device.

In step 2, the Quality Measurement Algorithm calculates the quality of the data stream received by the Receiving Device.

In step 3, the Receiving Device sends an indicator of the quality of the received stream of A/V Data to the Streaming Device.

In step 4, the Streaming Device analyzes the indicator of data quality received from the Receiving Machine. If the quality of data is below an accepted threshold, proceed to step 5. If the quality of data is not below the accepted threshold, proceed to step 6.

In step 5, the A/V Streamer adjusts the transfer parameters of the A/V Data stream in order to increase the data quality at the receiving machine. This may involve adjusting the sampling rate, bit rate, resolution, or any other parameters of the A/V Data.

In step 6, the Streaming Device continues to transmit the A/V Data stream without any changes.

The method ends.

This process runs continuously so that the A/V Data stream is adjusted in real time based on current receiving data quality.

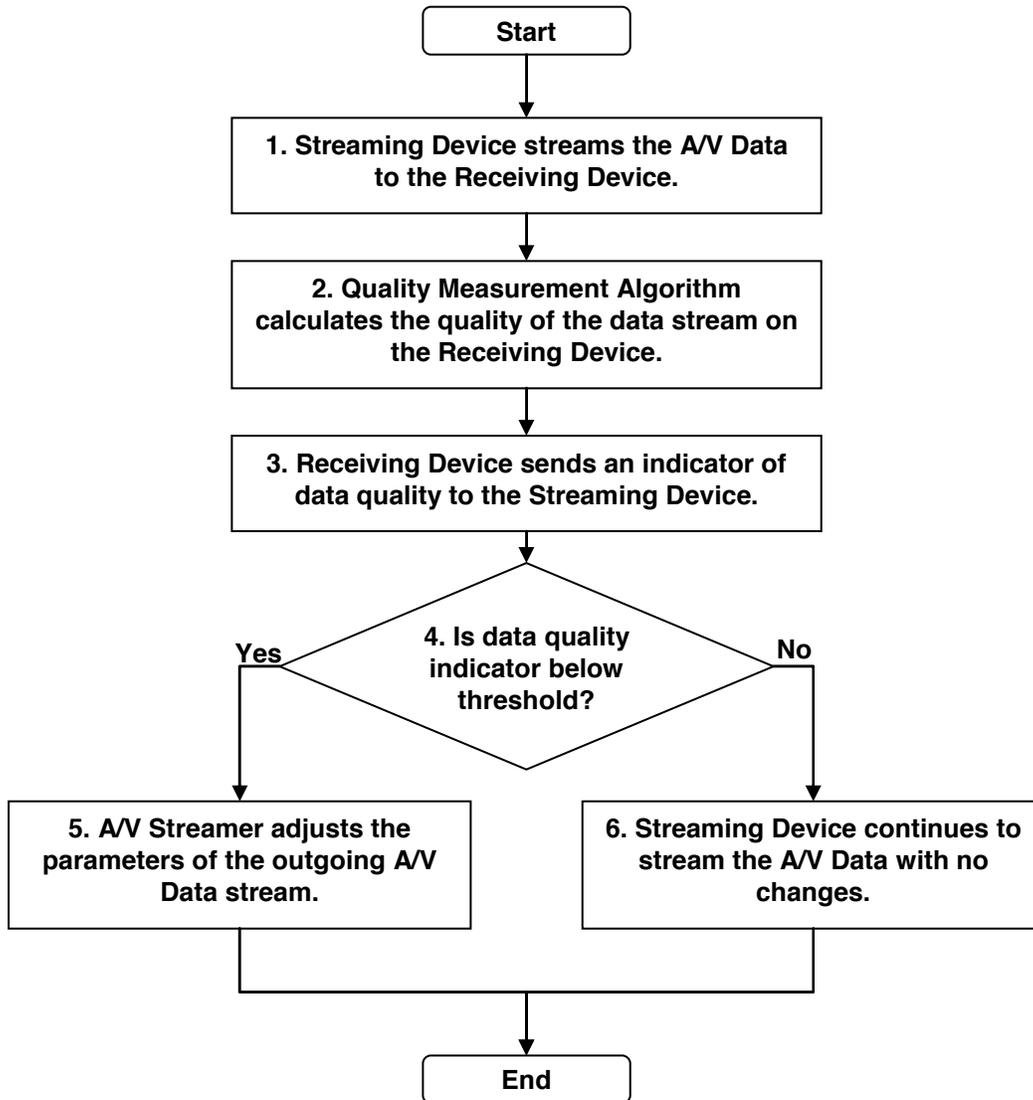


Figure 2. Method for Sampling Rate Adjustment.