RESEARCH PAPER | Information Technology | Volume : 3 | Issue : 8 | Aug 2013 | ISSN - 2249-555X

Analytical Study of Streaming Videos

KEYWORDS: Streaming video, methods, multiple bit stream

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ABSTRACT *Streaming video is content sent in compressed form over the internet and displayed by the viewer in real time. With streaming video or streaming media, a web user does not have to wait to download a file to play it. Instead the media is sent in a continuous stream of data and is played as it arrives. The user needs a player, which is a special program that uncompresses and sends video data to the display and audio data to speakers. A player can be either an integral part of a browser or downloaded from the software maker's web site.*

Introduction
The demand for multimedia information on the web is increasing day by day due to various multimedia applications such as distance learning, digital libraries, home shopping and video on demand. Recent advances in computing technology, compression technology, high bandwidth storage devices and high sped networks have made it feasible to provide real time multimedia services over the internet. Real time multimedia demand for streaming media is surging[1]. According to a recent industry study [7], there were 60 million people listening to or watching streaming media each month. Streaming video is a sequence of "moving image" that are sent in compressed form over the internet and displayed by the viewer as they arrive. For the transmission of stored video over the internet there are two modes such as the download mode and streaming mode (i.e. video streaming) [2].

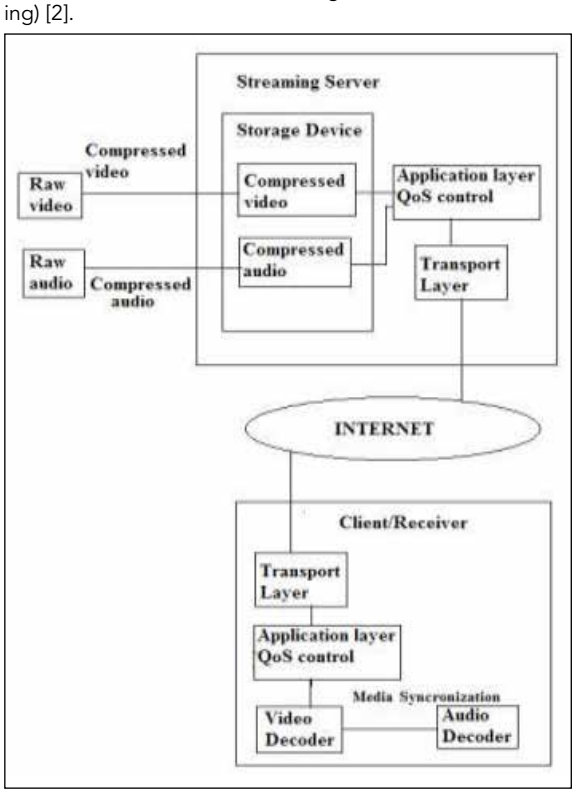

Figure 1: Architecture for video streaming. [6]

Video Delivery via Streaming
Video delivery by video streaming attempts to overcome the problems associated with file download, and also provides a significant amount of additional capabilities. The basic idea of video streaming is to split the video in to parts, transmit these parts in succession and enable the receiver to de code and playback the video as these parts are received without having to wait for the entire video to be delivered. Video streaming can conceptually be thought to consist of the following steps :

1. Partition the compressed video into packets
2. Start delivery of these packets.
3. Begin decoding and playback at the receiver while the video is still being delivered.

Video streaming enables simultaneous delivery and playback of the video. This is in contrast to file download where the entire video must be delivered before playback can begin. In video streaming there usually is a short delay between the start of delivery and the beginning of playback at the client. This delay , referred to as the pre roll delay, provides a number of benefits including low delay before viewing starts and low storage requirements since only a small portion of the video is stored at the client at any point in time. The length of the delay is given by the time duration of the pre roll buffer, and the required storage is approximately given by the amount of data in the pre roll buffer[4].

Streaming methods
There are primarily three streaming methods that are available today

Multiple bitstreams

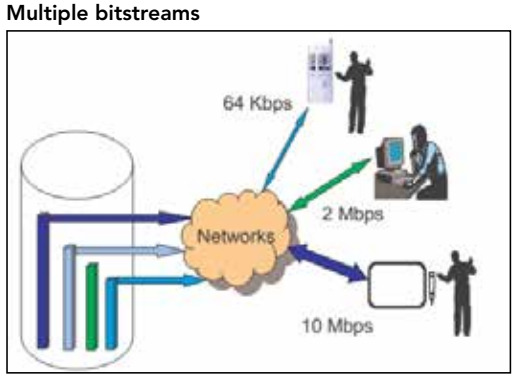

Figure 2. Streaming with multiple pre-encoded bitstreams with different bit rates, frame rates and spatial resolutions

Volume : 3 | Issue : 8 | Aug 2013 | ISSN - 2249-555X

In the first way, several bit stream for the same video with different bit rates, which may also have different temporal or spatial resolutions, have been stored in the video server. The end user can select the bit stream according to its capability and available bandwidth of the network. This method is shown in figure. The advantages of this method are that the compressed bitstream is optimized to the specified user and is the decoder has lower complexity since it only needs to receive and decode a single layer. The main disadvantage is that the video server must store multiple bit streams for the same video, which is redundant and could impose significant memory constraints with very large video repositories. Also, the different versions of the video have to be pre encoded, which makes real time applications almost impossible. This approach is also limited in the granularity that it could provide.

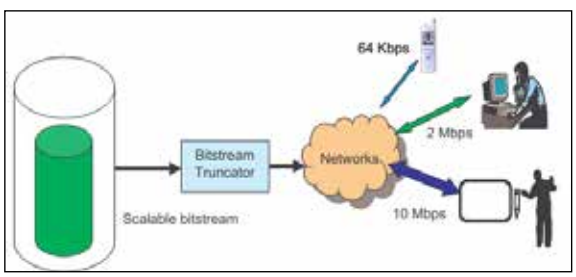

Figure 3. Streaming with bitstream coded with scalable video encoding

Single scalable bitstream

The second method of scalable video streaming is implemented with the scalable encoded video bitstream [3][5]. In this method the video is encoded once and stored in the video server. The encoded video bitstream can be truncated in ways such as SNR, temporal and spatial scalability based on the requirements of the end user and network condition as shown in figure. This method is attractive since it provides more flexibility in getting the desired compromise between granular scalability and coding performance. First , the coding technique must not incur significant loss of coding efficiency compared to single layer coding schemes. With significant loss in coding efficiency, it is likely that the content providers would choose not to adopt the coding format. The other issue is decode complexity. If the scalable decoder is costly to produce , then there may be limited or no deployment of devices capable of receiving scalable encoded bitstream.

Streaming with transcoding a single bitstream

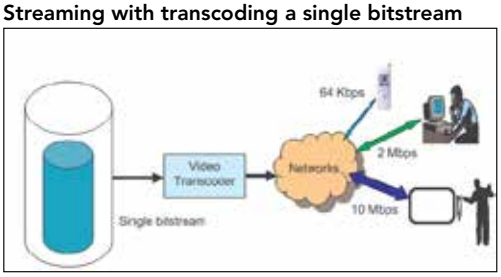

Figure 4. Streaming with transcoding a single bitstream

The third method is to use a single encoded bitstreams with higher quality as shown in figure. During the streaming , the bit stream are converted to match the end user device and network conditions with a trans coder. The key advantage of this method is that trans coding techniques could be easily installed on servers to satisfy a very diverse set of network and terminal constraints. The trans coding solution offers a layer of flexibility between the content providers who encode the data and consumers that wish to receive the data. The main drawback compared to scalable coding solution is that trans coding typically requires more computation than simple bit stream truncation. However , advances in the area of trans coding have pushed the complexity much lower than full re encoding of video without sacrificing quality.

Following table shows difference between various streaming methods

Streaming Methods	Advantages	Disadvantages
Multiple bitstreams	• High Quality • Simple Decoder	• Limited number if streams • Large storage
Single scalable bitstream	• Small storage • Multicast application • Simple bitstream switching	• Complicated decoder • Loss of coding efficiency
Single non scalable bitstreams with transcoding	• Simple decoder • Small storage • Capable of inserting new information for error resilience	• Drift is possible • Higher complexity • Additional delay

Conclusion

Video streaming is a vital constituent of many internet multimedia applications. The best effort nature of the current internet poses many challenges to the design of streaming video systems. In this paper, we have surveyed major approaches and mechanisms for internet streaming.

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