International Journal of Computational Intelligence in Control

IMPROVING THE QUALITY OF SERVICE ON VIDEO STREAMING IN CLOUD COMPUTING ENVIRONMENT

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Date of Submission:10th August 2021 Revised: 25th October 2021 Accepted: 13th December 2021

Abstract: Internet has increased dramatically with the development of 3G and 4G technologies in the recent years. The usage of mobile broadband internet on the devices like laptop, tablets and cellular mobiles has become very popular. Video streaming is the most popular multimedia application in mobile environment. The big challenge in this is without compromising the quality, these services should be provided to users in a cost effective manner. The above challenge is achieved by the development of the LTE (Long Term Evolution) technology in the mobile world. With low latency and high data rates, the effective multimedia services are provided to user by means of the features of LTE technology over cloud in the multimedia application. In this research paper, variable bit rate based Dynamic Headlight Prefetching model is proposed to improve the quality of service on the video streaming over the cloud environment using LTE network.

KEYWORDS: Video Streaming, Long Term Evolution, Cloud Computing, Variable Bit Rate, Constant Bit Rate.

1. INTRODUCTION

In live media streaming, the bit rate are used in the sound or video encoding, and the term variable bit rate (VBR) that relates the bit rate are used in telecommunications and computing fields. For the segment per time, there will be the change in the capacity of output data for variable bit rate files when compared to constant bit rate (CBR) [1] [2]. For the more complex segments of media files, the storage space will be more, and for less complex segments the less space is allocated and therefore VBR permits a higher bit rate. An average bit rate for the file can be produced and it will be calculated by the average of these rates [3] [4].

For the past years, many hardware and software players are not able to decode the variable bit rate files properly because the using VBR encoders were not well developed. For the interest of compatibility, because of this result there will be the common use of CBR over VBR. In the huge majority VBR encoded files are supported by the modern portable music devices and software and in the year of 2006 December the largely disused files are CBR encoded files that are supported by devices. In most digital audio players released by the companies like SanDisk, Creative Technology, Apple and Microsoft supports for VBR in AAC and MP3 files is founded. In some cases like audio books and acoustic music, when encoding monotone or minimal tones an audible artifacts were introduced occasionally in early VBR algorithms. During the silence portions of the song or when there was only speaking, a “digital chirp” is mimed by these artifacts. Later generation of the VBR standard, these problems have been settled by improving the VBR encoding algorithms [5][6][7][22] [23] [24] [25].

Media streaming in mobile environments has been attracting much attention lately. A real-time continuous media streaming protocol with special emphasis on dynamic transmission capacity allocation and pre-fetching is proposed. Nonstop middleware with partition prediction and service replication for continuous media streaming in mobile and ad hoc networks is developed. Video streaming techniques in 3G mobile networks on top of three-tier architecture is implemented [18] [19] [20] [21]. These are only focused on the coordination of media servers for smooth handover and the rate adaptation technique when a base station becomes overloaded. There is no coordination at the base station level or the user level. Data management issues, pre-fetching in particular, are largely ignored. Group mobility to predict the future availability of wireless links for increasing total streaming capacity is proposed. An iterative algorithm to predict continuous link availability between mobile users is proposed. The V3 architecture proposed for live video streaming is essentially a cooperative streaming architecture for moving vehicles. The AO2P algorithm proposed for privacy routing uses a mechanism such that a receiver geographically closer to the destination is assigned to a class with a higher priority for contending the channel to be the next hop. The routing request in AO2P is sent to all neighboring nodes [8][9][10].

The work on moving objects databases is needed to maintain dynamic data items. For representing and processing dynamic attributes such as locations and trajectories, spatial and temporal indexing methods are devised. The headlight pre-fetching is proposed for media streaming in mobile environments [11]. It has headlight pre-fetching zone that is a virtual fan-shaped area along the direction of user movement similar to the headlight of a vehicle. All service access pointers (SAP) of the cells that overlapped with the zone are selected as the prefetching SAPs.

2. BIT RATE

In telecommunications and computing, bit rate is the number of bits that are conveyed or processed per unit of time [12].

2.1 Variable Bit Rate (VBR)

It a term used in telecommunications and computing, that relates to the bit rate used in sound or video encoding. As opposed to constant bit rate (CBR), VBR files vary the amount of output data per time segment [13]. For the more complex segments of media files, a higher bit rate (more storage space is required) is allowed by VBR, whereas for less complex segments less space is apportioned. To produce an average bit rate for the file is to be calculated by the average of these rates.

Advantage

When compared to the same data of CBR file, VBR produces a better quality-to-space ratio. To encode the sound or video data more accurately by using the available bits in flexible manner, more bits are used in difficult-to-encode passages whereas in less demanding passages the fewer bits are used.

Disadvantage

Some hardware may not be compatible with VBR files for the complex process because it takes more time to encode. When the instantaneous bit rate passes the data rate of the communication path in streaming, some problem may present in VBR. During encoding or (at the price of enhanced latency) or by elaborating the play out buffer it debars those problems by confining the instantaneous bit rate [14].

3. PROPOSED DYNAMIC HEADLIGHT PREFETCHING MODEL

The headlight prefetching is proposed for media streaming in mobile environments. It has headlight prefetching zone that is a virtual fan-shaped area along the direction of user movement similar to the headlight of a vehicle shown in figure 1. All service access pointers (SAP) of the cells that overlapped with the zone are selected as the prefetching SAPs [13].

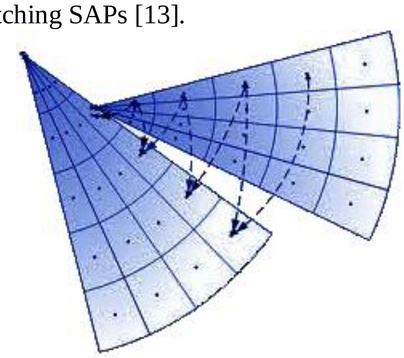

Figure 1: Headlight Prefetching

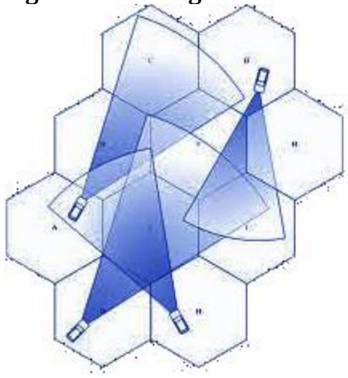

Figure 2: Headlight Dynamic Change

3.1 The Headlight Zone and the Computation of Virtual Illuminance

The problem is in determining the cell area covered by the headlight zone since the intersected area could be in any shape. To avoid the costly computation of the covered area, we use a much simpler approach to approximate the virtual illuminance. More specifically, we partition the headlight zone into smaller grids and pre-compute the virtual illuminance as well as the center of each grid. Since each grid is in a regular shape, the virtual illuminance can be easily computed by the following formula. On the need to determine the segment assignment of a particular cell, we simply add up the illuminance of all grids whose centers fall inside the cell. Since the granularity of the grids can be changed easily, we can have higher level of precision at any time by using finer partitioning[15][16].

3.2 Prefetching Segment Assignments

To determine the segment assignment, we need to consider both the user movement and media playing speed. Therefore, the number of segments that should be handled by the current cell is tP shown in figure 3.2. If the current media segment being played is Si, then SAPC must prefetch the segments Si+1, Si+2, . . . , Si+tP .The first segment that need to be prefetched by $SAPC_3$ is Si+tP +1. The expected number of segments to be handled is t_3P . The starting segment and the total number of segments to prefetch for all other SAPs within the headlight zone can be determined in a similar way. Since it is clearly not cost worthy for all such SAPs to prefetch the full range of segments, therefore we use the virtual illuminance as a weighting factor to determine the actual number of segments to prefetch. More specifically, the exact segment assignment for SAPCto prefetch is Parameters for determining the segment assignment.

3.3 Headlight Shifting

Headlight prefetching is quite effective for largely stable moving users. However, if the user makes a sharp turn, then most or even all of the prefetching done on the previous headlight zone may be completely useless since the user is no longer heading toward the predicted direction. We can of course start a new round of head light prefetching for the new situation. However, these will double the prefetching cost. Since the media stream is played continuously, the segments needed for the new headlight zone overlap significantly with that of the old zone. Therefore, the better way is to shift these segments to the new zone [17].

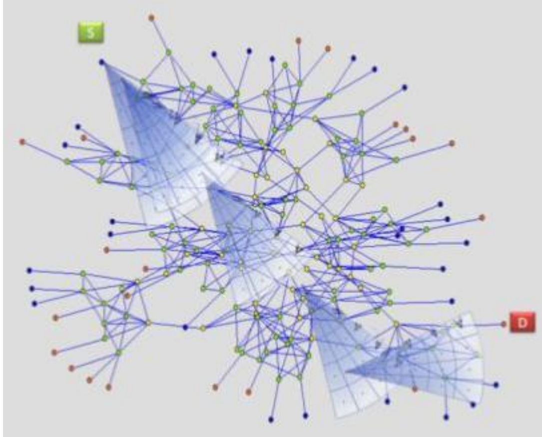

Figure 3: Headlight With Multipath Routing

3.4 Headlight Sharing

Headlight shifting only takes the headlight zone of one user into consideration. Segments not yet pre-fetched by any SAP of the old zone can only be retrieved from the remote source. Since the same media may be viewed by more than one user at the same time, especially for hot medias, the headlight zones of different users may have many segments in common. If they overlap with each others, then it is very likely that we can find the needed segments from other zones with or without shifting. We call this idea headlight sharing since segments pre-fetched for a zone by an SAP are shared with neighboring SAPs with overlapping headlight zones. Once a requested segment is located in the neighborhood, the cost of prefetching from the remote server can also be saved.

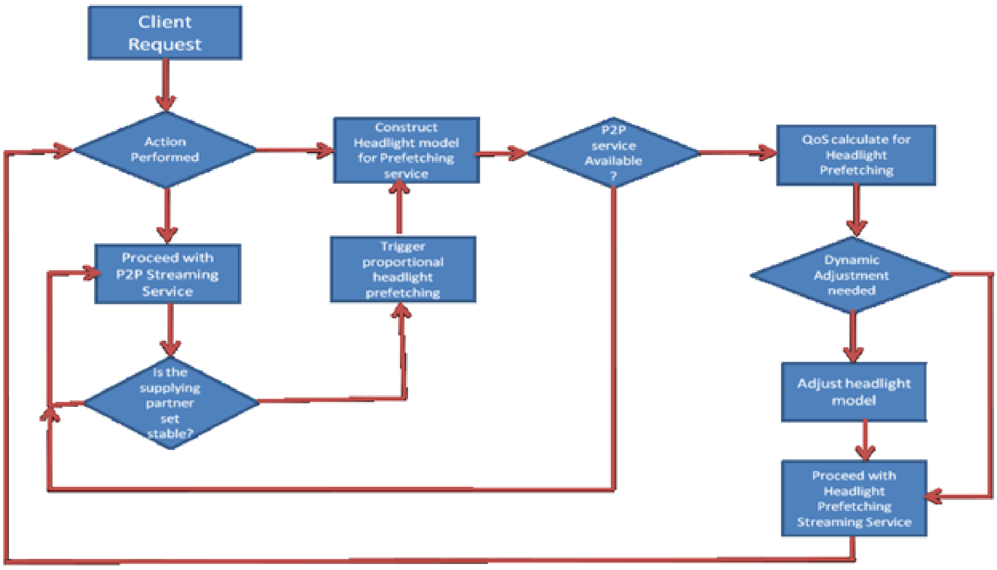

Figure 4: Architecture Diagram for Dynamic Headlight Prefetching Model

3.5 Proposed Model

In this proposed model, multi-level cooperative for Effective data streaming management techniques like VBR, dynamic headlight prefetching (shown in figure 3.3), multi-user resource allocation and mashed video sense chaining (shown in figure 3.4). An iterative algorithm to predict continuous link availability between mobile users is proposed. The V3 architecture proposed for live video streaming is essentially a cooperative streaming architecture for moving vehicles. And belongs to our proposed levels, we overcome the propagation delay this is our major contribution of this work.

3.5.1 Multi-User Resource Allocation and Mashed Video Sense Chaining

Using the possibilities of mashed sensing in Wireless Multimedia Sensor Network Environment for rate control, error correction and mashing of video, it presents a network system is designed. By a cross-layer system its transmission rate, channel coding rate and encoding rate to maximize the quality of received video and this is the actual objective of our research.

First, for transmission over wireless multimedia sensor networks (WMSNs) the encoding of video which is on the mashed sensing is examined. It is expressed that mashed sensing can defeat many of the present issues of video over WMSNs, for the channel errors the encoder complexity and low resiliency. It is shown that the rate of mashed sensed video can be predictably controlled by varying only the mashed sensing sampling rate. The above problem is defeated by the technique called Mashed Sensing (MS) concerning to video over WMSNs. By changing the mashed sensing sampling rate that controls the rate of Mashed Sensed Video (MSV). An option to the traditional video encoders, the MS encoder offers at very low computational complexity by enabling the imaging systems that sense and mash data simultaneously. In order to store or transmit for mashing the large amount of raw data is assumed and captured in conventional digital image or video capturing. The two main disadvantages are there in this process [19].

First, in some cases CMOS/CCD technology is limited and for particular wavelength assuming the large amount of raw image or video data can be expensive.

Second, in the case of video the computational complex one is mashing the raw data. Mashed Sensing (MS) is one to keep the important information and throw away the rest and the process of sample.

Using conventional methods there will be a difficulty to encode or capture many signals but it is possible in Mash Sensing (MS) method. A high-dimensional signal can be retrieved by the random measurements in small number. A mashing algorithm can be employed for each frame at a complete set of samples to be found which is needed by standard video capture systems. Obtaining those raw samples is hard or valuable in applications like imaging at non-visible (e.g. infrared) wavelengths shown in figure 4. In other applications like multi-image capture in camera network, it will be a challenge for implementing a mashing algorithm. In mash imaging hardware like single-pixel, from each frame the random measurements are collected independently and it can reduces these loads and the protocol for mashing is not needed.

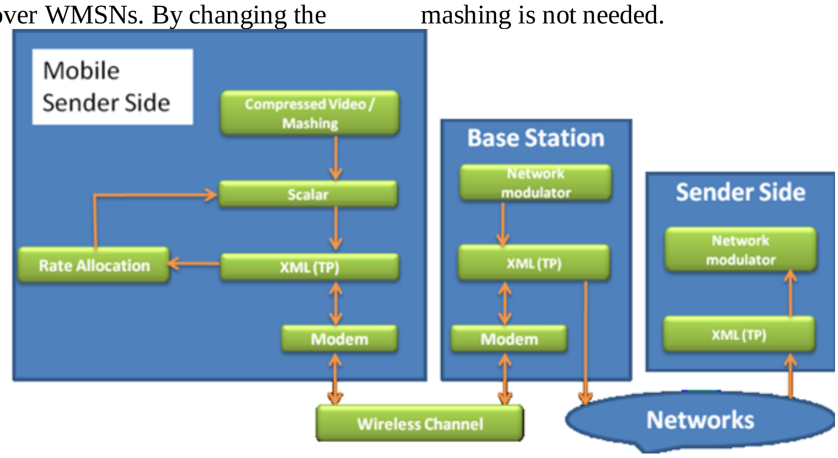

Figure 5: Architecture Diagram for Multipath Video Mashing Model

3.4.2 Rate Change based on Video Quality

The rate of transmission is depending on the received video quality and the system is based on this MS architecture. The information about the estimated received video quality used by the rate controller and it is mean in the rate control decision. The received video quality is very high which is found by the sending node and to enhance the rate it will be decreased. To enhance the quality of video its data rate is decreased by sending a node of poor-quality video.

3.4.3 Video Transmission using Mashing Samples

The video encoder can be developing based on mashed sensing. At low complexity based on the temporal correlation the frames can be captured and mashed by the difference of two frames of the MS samples.

4. EXPERIMENTAL RESULT AND DISCUSSION

The detailed experimental setup is shown in Figure 6. The packet flow in this experiment starts from the sender system, which generates the UDP packets with the help of Traffic generator and it passes to Gateway. This Gateway sends packets to receiver through LTE network. The receiver system connected to BTH Internet receives the packets. The transmitted traffic at the sender and receiver end is fed to the MP through wiretaps, which are connected to it by monitoring ports. The time stamping of packets at MP does not affect the actual packet flow, since the wiretaps duplicates the packets without disturbing the original packets.

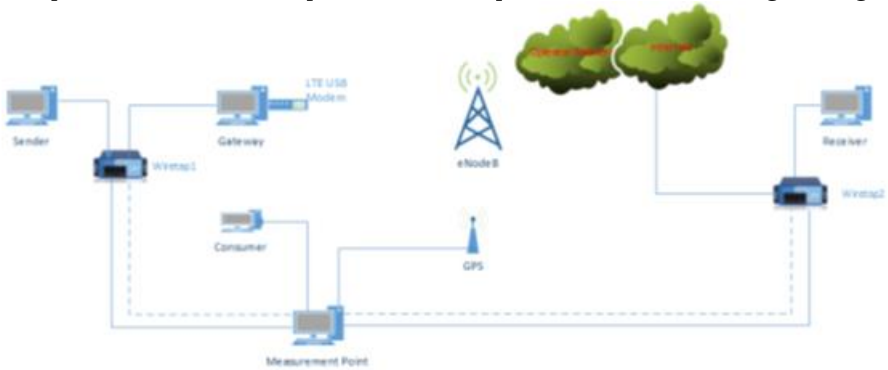

Figure 6: Detailed Experimental Procedure

The traffic generator tool consists of two programs, one is client program and the other is server program. The client program is installed in sender system and the server program is installed in receiver system. The client program consists of Experiment number (E), Run Id (R), Key Id (K), destination IP, destination port number, number of packets to be sent, length of packets and inter frame gap in micro seconds. The server program consists of Experiment number (E), Run Id (R), Key Id (K). The collected traces at the consumer are analyzed using Perl program, based on the sequence numbers along with above mentioned E, R, K values respectively. These values are used to recognize the packets at source and destination. By analyzing the collected traces we calculate the minimum, maximum and mean of packet loss percentage for different payloads at different data rates. Based on the calculated values we plotted the graphs. The main components in this setup are Gateway, Sender, Receiver, Measurement Point and Consumer.

4.1 Evaluation Metrics

Packet Loss (PL): The percentage of packet loss is calculated as the ratio of the number of packets lost (L) to the total number of packets sent by the sender (N). The number of lost packets is the difference in the number of packets received by receiver and the total number of packets sent by sender with unmatched sequence numbers.

$$P_L = L/N$$

The experiment is carried out for TCP and UDP protocol for checking the video quality by using the proposed Dynamic Headlight Prefetching model.

4.2 Packet Loss for UDP packets in Uplink

Figure 7a depicts the packet loss for UDP packets in Uplink. From the figure 7a, the packet loss effect for UDP packets at different data rates with varying payloads is not much significant. The few instances showing packet loss in the Figure 7a are not considerable loss compared to total number of packet sent and those are not even up to 1% of packet loss.

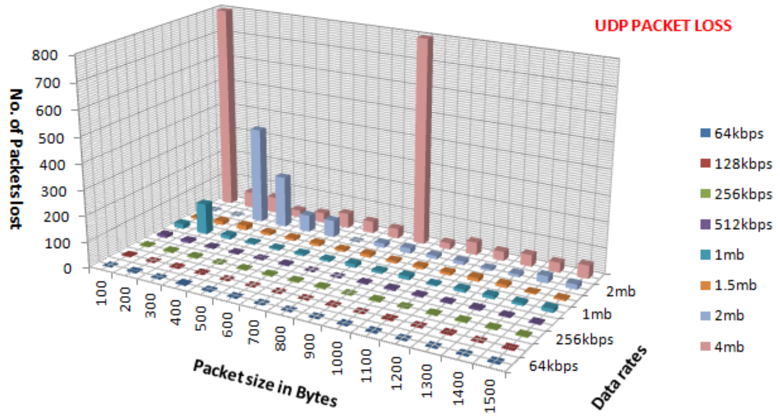

Figure 7a: Packet Loss for the generated UDP packets for Uplink

4.3 Packet Loss for TCP packets in Uplink

Similar to UDP, the packet loss effect for TCP packets at different data rates with varying payloads is much significant. The few instances showing packet loss in the Figure 7b are not considerable loss compared to total number of packet sent and those are not even up to 1% of packet loss.

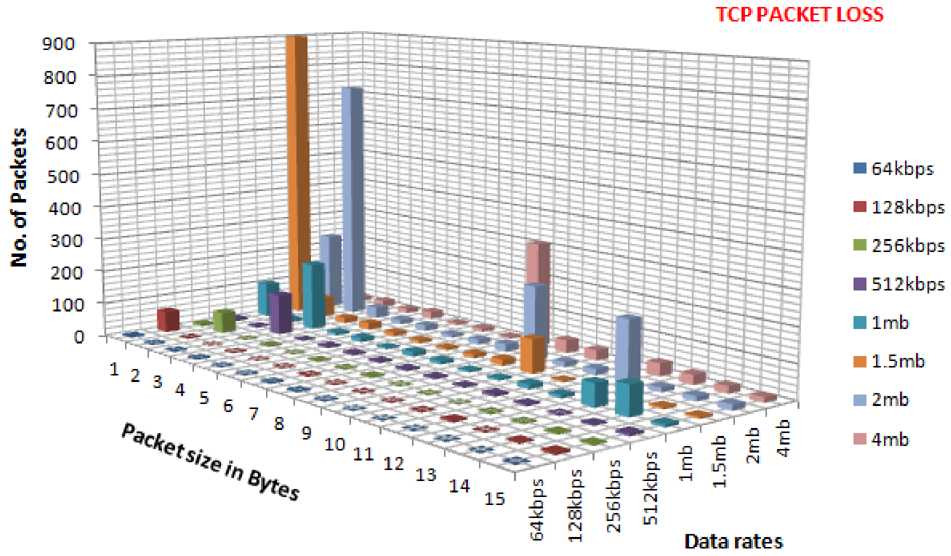

Figure 7b:Packet Loss for TCP packets in Uplink

5. CONCLUSION

In this work, the model is based on the performance of video streaming over cloud based LTE network. The work is deals with measurement of packet loss in the uplink of the LTE network. For this work we generated an artificial traffic with UDP and TCP packets of different payload sizes. This artificial traffic is streamed from sender to receiver with different payload sizes and at random Inter Packet Delay (IPD).In case of packet loss, we calculated the number of packets lost at different data rates for varying payloads. The whole set of analysis is done for both TCP and UDP of uplink in cloud-based LTE network. From the results obtained, it is clear that the proposed Dynamic Headlight Prefetching model effectively reduces the packet loss during the transmission of the packets over sender to receiver through the cloud based LTE networks.

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