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Adaptive Video Streaming With Multidimensional Quality Of Service (AVMQ)

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Abstract—
Web is the base for majority of the E-learning environments but the main aspect is the lack of arrangements to join up the technology, for service providers and different kinds of users as a whole. This lack of integration is seen widely on the content providers end where there is no emphasize on the quality of service factors (eg .EoE Delay, bandwidth, scalability, complexity) for the video contents with meta-file aspects in the hosted server. The focus of the proposed Adaptive Video Streaming with Multidimensional Quality of Service(AVMQ) model is on the QoS (Quality of service) of the each multimedia content services with the constraints (unacceptable, poor, Satisfactory, Excellent) same on the user's end where the user can access with ease of all the contents was uploaded. A QoS adjustment system allow the reservation of transmission capacity without a downtime administrations.

Index Terms—E-Learning , Multimedia, QoS, Video Streaming.

I. INTRODUCTION

Remarkable and booming achievement of spilling administrations like YouTube and NPTEL requires a genuine test particularly for organizational administrators to deal with the enormous movement inundation and to manage the clients in proficient way. The main objective is to locate a suitable standard for assessing QoE for extraordinary applications prevalent like YouTube and Netflix, yet there is no standard as of now that would reflect versatile streaming.
A QoS adjustment system could be valuable in contemporary systems despite the fact that these systems allow the reservation of transmission capacity without a down – time administrations. The variable piece rate (VBR) benefit is sufficient particularly for nonstop media. It holds some data transmission yet in addition an adjustment instrument can likewise be advantageous in utilization of the data transfer capacity. The Multimedia Communications Forum (MMCF) has built up a Multimedia Communications Quality of Service (QOS) archive, the first of its compose which offers the suppliers and clients widespread execution rules and administration parameters for sight and sound interchanges. These rules give execution goals against which mixed media arrangements can be determined and conveyed. In order to evaluate the simplified

Data Transmission, This System Is Based On The Following Assumptions:

1. Information Sockets are transmitted without misfortunes
2. Transmission organize condition is constantly steady
3. There are no slowing down occasions amid playback

The display of multimedia Communication is firmly based on
the manufacturer and subordinate arrangements for PCs including application programming from one perspective and by the keen system idea on the other. The layered model of proposed system for media correspondence involves constituents namely partitioning of complex data objects into area data writes with the end goal of either correspondence, putting away and preparing.. This

includes information, video or sound considering, the joining of various multimedia learning content. Standardization of administration parts for data write, conceivably with a few layers of quality for data composing. Point-to-point quality of service is dependent on the performance of each component involved in the e-learning network. Each component should perform to expectations, to achieve satisfactory end-to-end QOS. Efficient utilization of network resource is the primary concern of network service providers to attain profitable commercial market. The tremendous wireless subscriber population and the growing demand of multimedia services needs attention to improve Qos requirements.

II. RELATED WORK

Rich multimedia contents of online learning system set reliability and high speed network access as the baseline. A recent Cisco study predicts a million minutes of traffic on global IP networks for every second by 2021. Initial QoS algorithms are based on Integrated (Intserv) services or Differentiated services (Diffserv) (StaffanFredricsson& Christine Perey2005). These service models used traffic history to estimate the traffic load and traffic pattern to allocate resources. As the traffic changes periodically the predefined allocation was not suitable for ever changing traffic conditions. If high priority traffic appears a QoS performance of all the active users will get collapsed (Narendrashaha*et al.*2008).

Xiao *et al.* (2004) have proposed a mechanism to guarantee the audio and video transfer on wireless LAN using two-level of protection. The new voice and video traffic offers protection from the problem existing in first level. In the next level of protection they are protected from data traffic using CWmin& AIFSN. Simulation results revealed improvement in channel utilization. Static and dynamic partitions of bandwidth with respect to admission control over wireless LAN have been proposed by Zoran Bojkovic*et al.*(2008).

Various traffic on WLAN such as video/ audio/ data are measured to allocate the available bandwidth. Performance metrics used to represent QoS includes total

throughput, active flows, transmission time etc. Floris *et al.*(2012) have proposed a model that supports QoS in mixed networks. A careful analysis of the end-to end QoS for smooth migration from contemporary mobile networks to 4G networks has been done.

Ahmed *et al.* (2017) have proposed Connection Admission Control mechanism for combining the properties of data-link layer with datagram network layer in efficient traffic transmission and QoS support. The resource reservation protocol lacks the availability of resources in achieving improved performance during real time video content delivery . The proposed algorithm is implemented using OPNET simulator tool .The experimental results of CAC shown that it outperforms the other one.

Resource allocation scheduling algorithm allocates the available limited resources to a large number of users with guaranteed performance. Packet delay is considered as the main criterion for delay sensitive applications(Paul Rosler*et al.* 2018). The queuing model was used for reduction in the queue length and stabilizing the queue.

Sharma &Lin(2011) have proposed the Delay Weighted Matching algorithm (DWM) for a reduction in end-to -end delay. The DWM algorithm was too complex to be applied. The hybrid algorithm prosed by Ji *et al.*(2014) attempts to minimize asymptotic complexity of scheduling algorithm. Though the algorithm has ensured a guaranteed performance, the asymptotic analysis was more complex and the extension of general system setting was a difficult. Hence downlink transmission rate along with binary rate was considered.

III. PROPOSED WORK

The focus of the proposed model is to present a suitable standard for evaluating QoS for extremely popular e-learning applications like NPTEL and Byjus which would reflect adaptive streaming. This model AVMQ evaluates the quality of e-learning streaming services that finds out the applicable standard and identifies the facilities need to be added or developed for covering services such as NPTEL and Byjus. The process is outlined step by step as follows. Verification of QoE estimation of videos without stalling event is the 1st step. In the next step NS2 simulation environment is used for the assessment of algorithm which considers stalling

events .The required modification for different video quality and video codecs while vedio play back is brought finally. In the preparation stage, the portrayal of the e-learning content and testing technique were seen in the composed frame of each NPTEL video contents in web browser, mobile phones and tablets.

Table.3.1 Encoder Setting

Pixel Resolution	Video Transmission Range (in Kbps)
1920x1080	4000 - 6000
1280x720	2500 - 5000
954x480	800 - 2200
740x460	600 - 1200

The pixel resolution and the corresponding video transmission range given in Table 3.6 is used in QOE estimation. The Quality of Experience is estimated for the learning contents hosted in NPTEL server using Pearson correlation coefficient (R) and Root Mean Squared Error (DASH algorithm). NS2 simulator helps to combine several criterias for improving verification results.

A Problem Definition

It is essential to provide quaranteed delivery of learning contents to the learners with high prominence throughput. The pixel size changes for every multimedia files, which causes severe problem on user side. The proposed algorithm has overcome these issues by applying the state of the art features as follows.

1) Avoids confusion while transmitting data packets.
2) Condition of Broadcasting network is always stable.
3) No stalling events during playback.

The learning contents have been verified for the point to point EOE using the proposed model and high level of performance evaluation and more efficient throughput have been obtained.

B **Proposed Model**

The Adaptive Video Streaming with Multidimensional Quality of Service (AVMQ) model attempts at avoiding packet loss by attaching the MOS symbol in the data packets. Initially the data packets are sent along with the MOS symbol in a simulated traffic. If the data packets are received by the leaner successfully, this MOS symbol will be 1. When the data packets are not with-in the time series the value will be -1 sent from destination to the broadcaster. The broadcaster resends the data packet for MOS -1.The vido headers includes resolution, size, type and rate of video frame, bitrates and total frames.The testing count is based on initil data combination. SD of frame size is calculated with the help of frame size and type and then SD is used to calculate the avg P-Frame size which decides the compression ratio as per the AVMQ restricted time span .

C **Result and Discussion**

The proposed model was implemented with a set of constraints (Throughput, Scalability, Latency, EOE and user satisfaction ratio) taken for the evaluation process by AVMQ at different pixel rates of E-learning videos as input. For the Assessment of AVMQ 60 specific videos (15 videos with different resolution 360p, 480p, 720p and 1080p respectively) have been choosen. Average bitrate of each resolution correspods to encoder setting shown in table 3.1.The videos are tested with participants in random order in Linux platform based NS2-

Network stimulator . The various videos are transferred to the user with a high level of efficiency.

Algorithm : AVMQ
Input: E-learning multimedia content.
Output: High Efficiency+ MOA levels.
BCs ⟶ RCs
Send multicast– POP-RTS
RCs ⟶ BCs
If data s received Successfully
then
Set MOS Symbol 1
Else
UNR -1
Attach the MOS Symbol at the end of Send Data at each header
Send new
BCs ⟶ RCs
If MOS Symbol is 1 then
Send multicast–DATA
Else Resend
RCs ⟶ BCs
If Multicast DATA received Successfully then
Set MOS Symbol 1
else
Set UNR Symbol -1
Build First data Symbol
Send new DATA
BCs ⟶ RCs
If MOS Symbo then
Send next Multicast DATA
else
Resend same DATA

Efficiency Estimation

Developing a relevant analytical QoE model needs relationship between several dependant and independent variablesto predict the QoSwhich is represented as follows

$$y_m = \frac{1}{-\sum_{n=1}^{T} x_{m,n} k_j} \qquad (3.1)$$

Where, T is the total model features,
m – sample index,
n – feature index, and
k - model parameters .

Prediction values are in the range 0, 1 provided by signal function. Prelude normalization is applied to determine unknown coefficients and to optimize QoS parameters. This normalizing function progress the values to equalize the analytical assumption and variance. β_i values are normalized in data preprocessing procedure by giving the minimum and maximum values to it, as a result it gives

$$y_m = \frac{y_m - e}{(f - e)} \qquad (3.2)$$

Where e=1 and f=5 are MOS score min max values and $y_m \in 0, 1$. Z-normalization is used get best model prediction values.

$$x_m^n = \frac{x_m^n - E(x^n)}{\sigma x^j} \qquad (3.3)$$

Where x_m^n is the m^{th}feature value of the n^{th}type.
E - is the mathematical expectation and σ is the standard deviation of the n^{th} type feature values

The pixel resolution, rate , size and type of frame, total frames and bit rate are extracted from video packet headers to develop model feature. The selected initial data is scaled up for possible features. As an example the frame size and its type were used to build SD of I-frame size and avg P-frame size given as stdIFr and avPFrSz respectively. Logarithmic function is also used to

breed multiple features using the function ln(X + 10−5) where X is the feature value obtained. The term 10-5 will be removed for the purpose of simplication. It is eventual to generate around sixty different features with the few available. The developed features are categorized to extract useful information.

1. Resolution-based features
2. Bitrate-based features
3. Compression-ratio-based features
4. Standard-deviation-based features
5. Frame-number-based features
6. Frame-size-based features

In the above X is I / P which is the frame type. These features are applied to improve QoS of streaming videos.

D **Performance Analysis**

The performance of our intended Adaptive Video Streaming with Multidimensional Quality of Service (AVMQ) model has been measured using the metrics Throughput Scalability, Latency, EOE and user satisfaction ratio at different pixel rate of E-learning videos as input.

The data transfer from the user interface, shows the storage and retrieval of multimedia content information. The data packet contained a certain part of the huge data which was transferred from the server to user with a high speed.

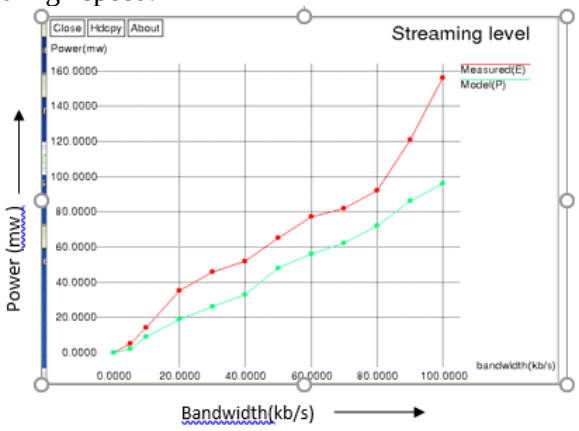

Fig. 1. Streaming Efficiency

The above graph depicts the streaming power efficiency of the proposed model. Effective bandwidth utilization is the key challenging issue in video streaming. If the transmission by the sender is more than the available bandwidth then packet loss will be higher. The slower transmission rate results in sub optimal video quality. Hence our proposed model estimates the available bandwidth to match the transmitted video in bit rate.

Performance optimization

Performance optimization is to maximize the content delivery to the enrolled learners The following graph shows the performance of the AVMQ model. There is no video freezing, and no loss of synchronization of audio and video. The performance requires same additional compatibility in client/server software.

Fig. 1. Magnetization

Table. 2. Bit rate of data files

File Name	*Tablet (kbps)*	*Smartphone (kbps)*	*Browser (kbps)*
Pdf	0.332	0.327	0.253
Audio	0.581	1.981	0.432
Video	0.768	1.869	0.234
Audio, video	0.324	1.234	0.325

The above table describes the bit rate of data files transformation, which makes appropriate values shows the data packet transformation in a high level. The data are categorized as Pdf, Audio and Video and are transferred as a packet to the receiver, with bit rate-based and resolution-based and their combinations and functions.

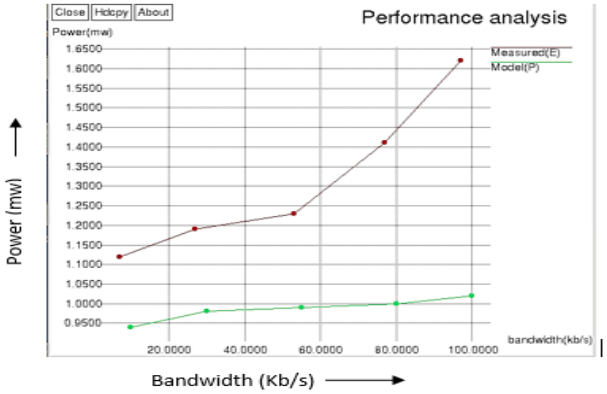

Fig. 2. Throughput Comparison

The throughput with respect to packet loss of the proposed model is compared with the existing model for varying bandwidth which is shown in Figure 2. The results of the graph shows that the impact of bandwidth is directly proportional to throughput , as bandwidth increases throughput also increases.

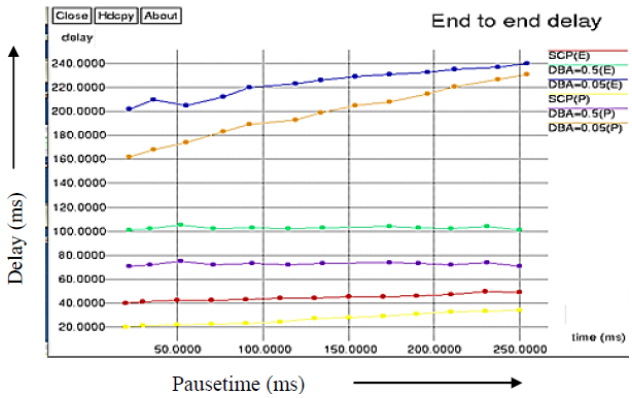

Fig. 3.EoE delay of AVMQ with Existing Model

This Figure 3 shows the variation on end to end delay factor with respect to the application protocols namely SCP (Session Control Protocol) and DBA(Dynamic Bandwidth Allocation Protocol). When pause time increases delay is also increases because more number of nodes is present for communication.

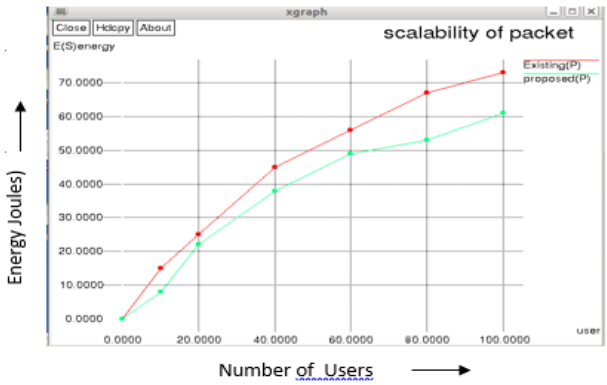

Fig. 4.Scalability of Packet with existing model

Figure 4 depicts scalability of packets in terms of energy consumption over the number of users. The energy consumption is measured in Joules. From the graph it is inferred that the energy consumption of the proposed model is lesser than the existing model for the increase in number of nodes

The proposed model AVMQ has taken the few quality parameters to measure the delivery quality of service of E-learning multimedia contents from the broadcasting server with N number of users with set of pixel rate variation was experimented successfully with NS2 simulator.

IV. CONCLUSION

The proposed model able to adapt the Qos settings dynamically for the selected online platform NPTEL and Byjus. Due to dynamic property new video codecs and/or new parameters of conventional video codecs are selected. The new feature is added into the model. Standard independent features, e.g. bitrate-based and resolution-based and their combinations and functions have been selected. They can be considered and used as long-term background of the future QoS prediction models with high application potential in next generations of 5G mobile networks.

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