A Framework to Utilization of Wireless Link Capacity for Mobile Video Streaming and Video Sharing in Social Networks using Cloud

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***Abstract*-- As and when the mobile users are increasing in day by day the demands of video traffic over mobile networks keep on rising, so the wireless link capacity cannot satisfying the demands of mobile user due to the variation in the link status and many disruptions, it causes long time buffering to mobile user. To overcome from this a framework is proposed for the efficient utilization of wireless link capacity by the combination of Adaptive mobile video streaming [AMoV] and Efficient social video sharing [ESoV] techniques using cloud. In AMoV, there is a combination of adaptability and scalability features, So that it provides efficient utilization of bandwidth. Likewise ESoV provides efficient social video sharing by use of same combination of features. So that user experiences continuous flow of video streaming by avoid of buffering.**

***Keywords*-Adaptive video streaming, cloud computing, mobile networks, scalable video coding, Efficient social video sharing.**

I. INTRODUCTION

Over the past decade, increasingly more traffic is accounted by video streaming and downloading. While the video streaming is not so challenging in connection-oriented networks, but in wireless link video streaming is challenging task. Network operators are made efforts to enhance the wireless link bandwidth (e.g., 3G and LTE) to satisfy demands from mobile users but while receiving the video streaming packets via 3G/4G mobile networks, the mobile users are suffer from long buffering time and intermittent disruptions due to the limited bandwidth and link condition fluctuation caused by multi-path fading and user mobility. Thus, it is crucial to improve the service quality of mobile video streaming while using the networking and computing resources efficiently.

Many studies are made to improve the service quality of mobile video streaming on two aspects:

• **Scalability:** Mobile video streaming services should support a wide spectrum of mobile devices; they have some change in video resolutions, some change in computing powers, and some change in connection-less links (like 3G and LTE) and so on. Also, the availability of a bandwidth of mobile device may vary over time and space depending on its signal strength. Storing the different versions (with different bit rates) of the same video content may incur high overhead in terms of storage and communication. To overcome from this problem, the Scalable Video Coding (SVC) technique of the H.264 compression of video standard defines a base layer (BL) with multiple enhance layers (ELs). These substreams can be encoded by exploiting three scalability features: (i) spatial scalability by layering image resolution (pixels of screen), (ii) temporal scalability by layering the frame rate, and (iii) quality scalability by layering the compression of image. By this scalable video coding, a video can be played at the lowest quality if only the BL is transmitted. However, the more ELs can be transmitted. By this best quality of the video stream is achieved.

•**Adaptability:** Traditional video streaming techniques designed by considering relatively stable traffic links between servers and users perform poorly in mobile environments. Thus the variation in the bandwidth status should be properly dealt with to provide ’tolerable” services of video streaming. To address this problem, we have to adjust the video bit rate adapting to the currently time-varying available link bandwidth of each mobile user. Such adaptive streaming techniques can efficiently reduce packet losses and bandwidth waste.

Recently social network services (SNSs) are popular and increases in order. There have been demands to improve the quality of content delivery using SNSs. In SNSs, users may share, comment or re-post videos among friends and members in the group, which means a user, may watch a video that her friends have recommended. Users in SNSs can also follow famous and popular users based on their interests (e.g., an official facebook), which is to be watched by its followers.

In this design an adaptive mobile video streaming and efficient social video sharing is used, a framework is proposed for mobile users by keeping above objectives in mind, dubbed AMES-Cloud. AMES-Cloud which is used by its two main parts: Adaptive mobile video streaming [AMoV] and ESoV Efficient social video sharing [ESOV]. In AMoV, there is a combination of adaptability and scalability features. Similarly ESoV provides efficient social video sharing by the use of same combination of features. So that user experiences continuous flow of video streaming by avoid of buffering.

II. RELATED WORK

A. *Adaptive Video Streaming Techniques*

The success of next-generation mobile communication systems depends on the ability of service providers to engineer new added-value of rich multimedia services, which impose constraints on the underlying delivery/transport architecture [2]. The reliability of real-time services is essential for the viability of any such services offering. The packet loss typical of wireless channels can be addressed using appropriate techniques such as the widely used packet- level forward error correction [FEC]. By design of channel-aware media streaming applications, two challenging and interrelated issues should be tackled: accuracy of characterizing channel fluctuations and effectiveness of adaptation at application-level. The first challenge needs thorough insight into channel fluctuations and their manifestations at the level of application, while the second dealt with the way those fluctuations are interpreted and dealt with by adaptive mechanisms such as FEC.

Adaptive video streaming over HTTP is gradually being adopted [3], as it offers significant advantages in terms of both user-perceived quality and resource utilization for content and network service providers. In this paper, it focuses on the rate-adaptation mechanisms of adaptive streaming and experimentally evaluates two major commercial players (Smooth Streaming, Netflix) and one open source player (OSMF). This covers three important conditions of operating. First, how does a video player adaptively react to either persistent or short-term changes in the underlying network available bandwidth? Can the video player quickly convert to the maximum sustainable bit rate? Second, what happens when two adaptive video players compete for available bandwidth in the congested link? Can they share the resources in a fair and stable manner? And third, how does streaming adaptively perform with live content? Is the player will sustain to a short playback delay? This identifies more differences between the three players, and significantly not sufficient in each of them.

B. *Mobile Cloud Computing Techniques*

The cloud computing has been well developed to provide video streaming services, especially in the wired Internet because of its scalability and capability.

There has been a recent trend that video-on-demand (VoD) providers such as Netflix are leveraging resources from cloud services for multimedia streaming [5]. In this, it considers the scenario that a VoD provider can make reservations for bandwidth guarantees from cloud service providers to guarantee the streaming performance in each video channel. It proposes a predictive resource auto-scaling system that dynamically books the minimum bandwidth resources from multiple data centers for the VoD provider to match its short-term demand projections.

Mobile devices such as smartphone, tablet pcs, etc... are increasingly becoming an essential part of human life as the most effective and convenient communication tools not bounded by time and place[4]. Mobile users accumulate rich experience of various services from mobile applications such as iPhone apps, Google apps, etc... which run on the devices and/or on remote servers via wireless networks. The rapid progress of mobile computing (MC) becomes a powerful trend in the development of IT technology as well as commerce and industry fields.

These techniques motivated to design the framework called AMES-Cloud by using virtual agents in the cloud to provide adaptive video streaming services.

III. PROBLEM STATEMENT

A. *Existing System*

The SVC extension of H.264/AVC is suitable for video conferencing as well as for mobile to high-definition broadcast and professional editing applications.

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These substreams can be encoded by exploiting three scalability features: (i) spatial scalability by layering image resolution (pixels of screen), (ii) temporal scalability by layering the frame rate, and (iii) quality scalability by layering the compression of image. By this scalable video coding, a video can be played at the lowest quality if only the BL is transmitted. However, the more ELs can be transmitted. By this best quality of the video stream is achieved.

In the existing system when user types a URL in mobile browsers, it lets user to navigate to the respective page and if that page has an embedded video in the URL it starts streaming using the mobile network whether (WI-FI, GPRS) and based on the strength of the signal it keep on streaming as well as playing. If the resolution is HD or high it will take time to stream and play in that case user gets paused till it stream and play. In the mentioned situation it has time delay to watch the video which user has requested. This technology has several advantages and disadvantages.

Some of the advantages are Video can be played at the lowest quality if only BL is delivered and also it is Used for video conferencing and Mobile to high-definition broadcast.

Some of the disadvantages are it always uses the maximum link capacity for video streaming and it cannot control the resolution. In case of weak signal user gets paused on the screen till video streams so cannot maintain constancy also in the video streaming.

B. Proposed System

In this system an adaptive video streaming and efficient social video sharing framework for mobile users by keeping above objectives in mind, dubbed AMES-Cloud. AMES-Cloud creates a private agent for each of the mobile user in cloud environments, which is used by its two main parts: **AMoV** (adaptive mobile video streaming), and **ESoV** (efficient social video sharing).

AMoV offers the best possible video streaming experiences by adaptively controlling the streaming bit rate depending on the fluctuation in the bandwidth. AMoV adjusts the bit rate for each mobile user leveraging the scalable video coding technique. The private agent of a mobile user keeps track of the feedback information on the status of link. Private agents of users are dynamically initiated and optimized in the cloud platform. Also the real-time scalable video coding is done on the cloud computing side efficiently.

From the analysis of the SNS activities of mobile users, ESoV seeks to provide a user with instant playing of video clips efficiently by the way of HTTP live streaming.

The advantages of this proposed system takes care of maximum utilization of bandwidth. User never gets paused while watching video due to prefetching mechanism so streaming constancy is always maintained and also user can watch multiple videos together and framework will take care of resolution conversion.

IV. AMES-CLOUD FRAMEWORK

The AMES-Cloud framework includes two methods, one is Adaptive Mobile Video streaming (AMoV) and another one is Efficient Social Video sharing (ESoV).

As shown in Figure 1, the whole video storing and streaming system in the cloud is called the AMES Cloud. In the AMES Cloud adaptive video streaming and scalable video coding techniques are used. First in adaptive video streaming HLS [HTTP live streaming] protocol is used. Based on the request of particular video from the user it converts video in to different bit rates by dividing video streams. Each bit rate of video streams is saved in .TS files extension. All of the .TS files are saved in M3V8 format. M3V8 is the text file containing all the .TS files extensions. It can deliver the video packets to user based on the bandwidth status. It adjusts the bit rate when there is fluctuation or any disruptions in the link. If there is vary in link status it delivers particular bitrates to user so that packet loss is avoided and video quality is not changed. One more added advantage is that it uses TCP, it can get back the video packet by requesting to server which packet is lost while transferring to user. So that loss of packet is fully avoided thus user can get best quality of video streaming.

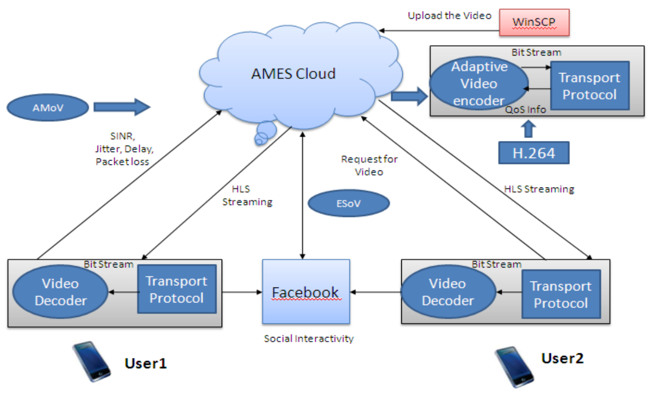


Figure 1. AMES-Cloud framework.

Another technique is scalable video coding, for each user their screen sizes are different in their mobiles. Based on the users screen size video is decoded from AMES cloud and it encodes the video and transfers to mobile user. It uses session description protocol [SDP] first it checks the bandwidth status of user mobile, how much frames he can receives per second. Based on the link status cloud server deliver the encoded video streams to mobile user. Though first time buffers will happen because SDP checks link status but later without buffering it transfers the video packets to user so that user experiences continuous flow of video streaming.

Here users can share the video present in AMES cloud to his or her friends by public posting of video path to cloud in their timelines or he or she can just send a video path of the cloud server to his or her friends in the form of message. Another concept we adapted here is live streaming, Users can record the video in one mobile lively and his or her friends can watch the video in other mobile by sending live recording video path using cloud.

V. ADAPTIVE MOBILE VIDEO STREAMING

A.SVC

As shown in Figure 2, traditional video streams with fixed bit rates cannot adapt to the fluctuation of the bandwidth. For a particular video stream bit rate, if the sustainable bandwidth link varies much, the streaming of video can be frequently terminated due to the packet loss.

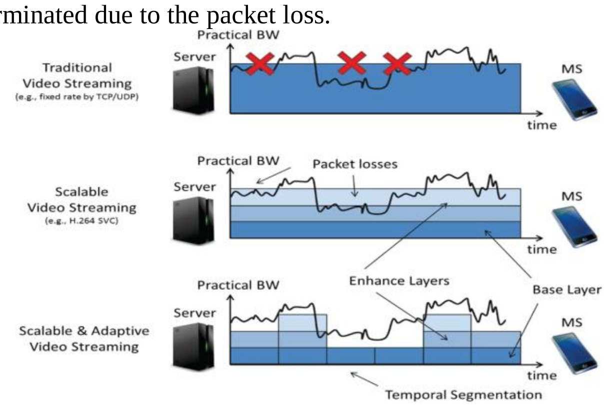


Figure 2. A comparison of the traditional video streaming and scalable video streaming

In Scalable video coding, a combination of the three layer scalability is called the Base Layer (BL) while the enhanced combinations are called Enhancement Layers (ELs). To this regard, if base layer is guaranteed to be delivered, while more enhancement layers can be also obtained when the link status cannot change, thus a better video quality can be expected.

By using scalable video encoding techniques, the server needs not concern on the client side or the link quality. Even some loss of the packets also the client still can decode the video and play the video. But this is still not efficient in bandwidth due to the unnecessary loss of packet. So it is necessary to control the scalable video coding-based video streaming at the server side with the bit rate adaptation method to efficiently utilize the bandwidth link.

B. Matching Between Bandwidth Prediction and SVC Segments

The functional structures of mobile user and the cloud server are illustrated in Figure 3. The cloud server monitor the link status at the mobile user while transferring video packets, its keeps tracking on metrics including signal strength, packet round-trip-time (RTT), jitter and packet loss with a certain duty cycle using SDP protocol.

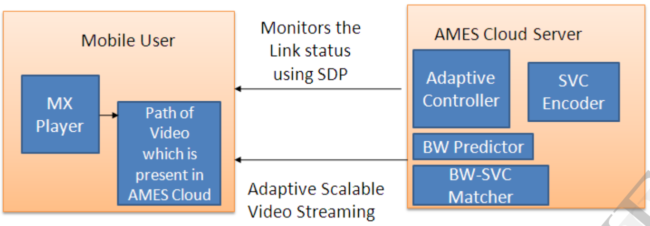


Figure 3. Functional structures of the mobile user and the cloud server

Once the Cloud server gets the information of the link quality status, it will perform a calculation and predict the potential bandwidth in the next time window. Sequence number of current time window is, the predicted bandwidth can be estimated by:

$$BW_{i+1}^{estimate} = BW_i^{practical}.\ [\alpha.\ f\,(\,p_i, p_{i-1})+\beta.\ g\,(\,RTT_i, RTT_{i-1})+\gamma.\ h\,(\,SINR_i, SINR_{i-1}\,)]$$

Where, $\alpha+\beta+\gamma=1$ is the importance of each factor, ‘p’ is for rate of packet loss, ‘RTT’ is for round-trip-time, ‘SINR’ is for the signal to interference noise ratio, and f(), g(), h(), are three functions reflecting the value change of each factor compared with that of last time window.

Suppose there are totally j enhancement layers, and the bit rate of the jth enhancement layer is denoted as R_{EL_j} while the bit rate of the BL is R_{BL}. Let BL_i indicate the SVC segment of BL with temporal sequence i, and let EL_i^j indicate the SVC segment of the jth EL with sequence i. So that the matching algorithm between predicted bandwidth and scalable video coding segments is shown in algorithm as following:

Matching Algorithm between bandwidth and segments:

i = 0
$BW_0 = R_{BL}$, Transmit BL_0
Monitor $BW_0^{practical}$ //First send the base layer segments
repeat
    Sleep for T_{win}
    Obtain p_i, RTT_i, $SINR_i$ etc., from client’s report
    Predict $BW_{i+1}^{estimate}$
    k = 0
    $BW_{EL=0}$
    repeat
        k++
        if k >= j break
        $BW_{EL} = BW_{EL}+R_{EL}^k$
    until $BW_{EL} >= BW_{i+1}^{estimate} - R_{BL}$
    Transmit BL_{i+1} and EL_{i+1}^1, EL_{i+1}^2,……, EL_{i+1}^{k-1}
    Monitor $BW_{i+1}^{practical}$
    i++
until All video segments are transmitted

VI. EFFICIENT SOCIAL VIDEO SHARING

A. Social content sharing

The social activities among users in social network services [SNSs], are public posting and direct message. For sharing videos in SNSs, one can post a video in the public, and his/her friends can quickly see it; one can also directly recommend a video to specified friends.

Here Classification of the social network services in to two kinds, regarding the impact of the activities and the potential reacting priority from the point of view of the recipient:

- **Direct recommendation:** In SNSs, a user directly recommends a video to particular friends by sending short message of video path. The recipients/friends of the message may watch the video with very high probability.

- **Public sharing:** Each user in SNSs has a timeline-based activity, which shows his/her recent activities of posting videos. The activity of a user sharing a video can be seen by his/her friends or followers.

B. Live streaming of video

Nowadays live streaming of video becoming popular, here by using AMES cloud server we can perform live streaming of video in efficient manner. One user can record the video of conference or any programs which is going on, in one mobile and his or her friends can watch the video in other mobile in different place by sending live recording video path which is present the cloud.

VII. STREAMING FLOW BY AMoV AND ESoV

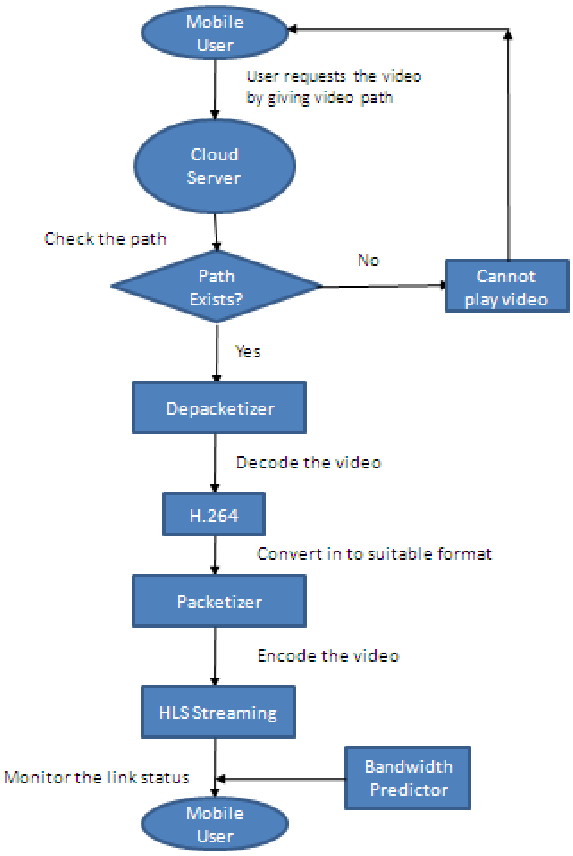
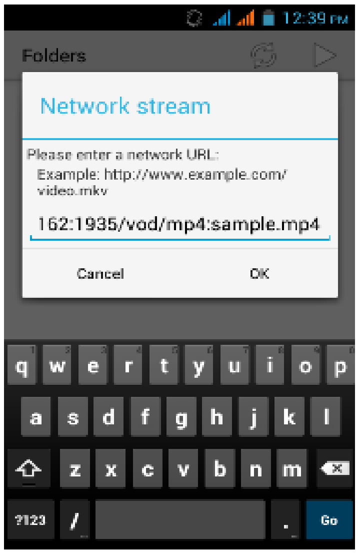


Figure 4. Working flow of video streaming

The two parts, adaptive mobile video streaming and efficient social video sharing, in AMES-Cloud framework have tight connections and will together service the video sharing and streaming, they both stand on the cloud computing platform. First the mobile user requests the video which is presented in AMES-Cloud by sending video path in user's player. Cloud server checks the requested video path from the mobile user, it is existed or not, if it is not existed then it reports to user that cannot play video otherwise it decodes the video from AMES-Cloud and encodes the video in to suitable format which is required at the user side using scalable video coding technique. By using HLS streaming it delivers the video packets in different bit rates to user by monitoring link status.

VIII. RESULTS

1. Send path of the video through Mxplayer

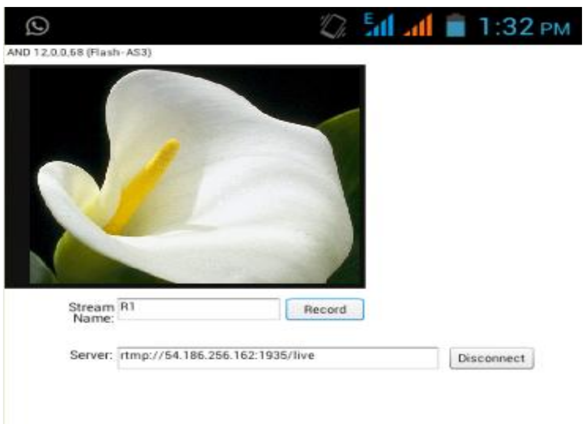


By sending path of the video which is present in AMES-Cloud server from the user's mobile Mxplayer, users can view the best quality of video.

2. Video plays what user entered video path to Mxplayer

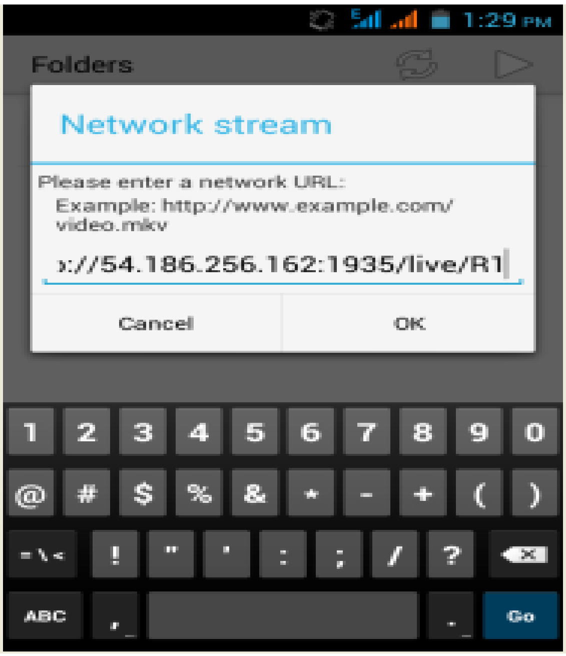
Video played at the best quality without any disruptions or long time buffering.

3. Record the video of live environment through webcam



One mobile user record the video of live environment through webcam and send the path of the live video to his or her friends to watch the live video which is going on. Ex: Any conferences.

4. Other users can view the live video from other mobile



Other users can watch the video of live conference/any other programs from other mobile by entering the path of the live video to cloud server.

5. Live conference/any other programs video plays in other user mobile.

Live conferences of video played at the other user mobile who wants to watch the live video. Many numbers of user can watch the live video at a time without any disruptions

IX. CONCLUSION

Scalable video coding and adaptive streaming techniques can be jointly combined to accomplish effectively the best possible quality of video streaming services. This can dynamically adjust the number of SVC layers depending on the current link status. This Proposed System will reduce the traffic and it will provide the maximum utilization of the bandwidth capacity thus User can seamlessly enjoy the video streaming over weak or strong signal of (WI-FI/GPRS) without buffering. Users can also efficiently share or view the video in social networks without any disruptions or any long buffering delay.

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