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Efficient Mobile Video Streaming and Sharing in Cloud Environment

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Abstract : ***When we consider about the video Streaming and Sharing over the Mobile network have been souring, the wireless network link capacity cannot keep up with the video traffic demand. We propose the new video streaming framework which has the two main part EMVS(Efficient Mobile Video Streaming) and EMVS(Efficient Mobile Video Sharing) . This enables faster video streaming and sharing in Cloud Environment for Mobile devices.***

Keyword—**EMVS, Mobile, Cloud, Wireless network**

I. Introduction

In the last ten years, rapidly increased more traffic is discovered by video streaming and downloading. Specifically, video streaming activities over mobile networks have become tedious over the past few years. While the video streaming is not so difficult in wired networks, mobile networks have been facing difficulties from video traffic transmissions over the less bandwidth of wireless links. Despite network operators' desperate lot of efforts to enhance the wireless link bandwidth (e.g., 3G, 4G and LTE), soaring video traffic demands from mobile device users are rapidly overwhelming the wireless link capacity.

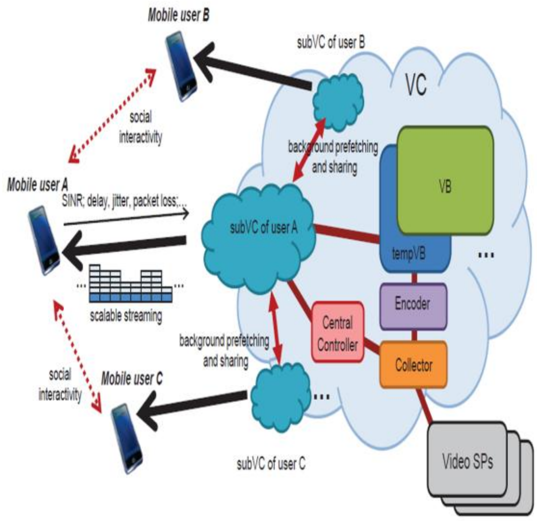
While receiving the video streaming traffic through 3G or 4G mobile wireless networks, mobile users often getting the long buffering period and disruptions due to the less bandwidth and link condition damages caused by multi-path fading and user mobility. Thus, it is important to enhance the service quality of mobile video streaming while using the networking and computing resources efficiently.

Recently there have been many discussions on how to enhance the service quality of mobile video streaming on two aspects:

Scalability: In a Mobile network video streaming services should support a wide range of mobile devices; they may have different video resolutions, different manipulating powers, different wireless links (like 3G, 4G and LTE) etc. Also, the present link capacity of a mobile device may vary over time and space depending on its signal strength and bandwidth. To address this problem, the Scalable Video Coding (SVC) methodology of the H.264 AVC video compression standard defines a base layer (BL) with multiple enhance layers (EL).

These sub streams can be encoded by exploiting three scalability features: (i) spatial scalability by reducing image resolution (screen pixels), (ii) temporal scalability by reducing the frame rate, and (iii) quality scalability by reducing the image compression. By the Scalable Video Coding, a video can be decoded/played at the less quality if only the BL is delivered. Anyhow, the more EL can be delivered, the good quality of the video is streamed.

Adaptability: The video streaming techniques structured by considering relatively stable traffic links between servers and Client(users), perform poorly in mobile devices on environments. Thus the problems on wireless link status should be properly dealt with to deliver the 'tolerable" video streaming services. To address this problem, we have to adjust the video bit rate adapting to the currently time-varying available link bandwidth of each mobile device user. Such adaptive streaming methodology can effectively reduce packet losses and bandwidth wastes. Scalable video coding and adaptive streaming methodology can be combined to accomplish effectively the better possible quality of video streaming services. That is, we can adjust the number of SVC layers depending on the current link status dynamically.



II. Material and Methodology

A. Adaptive Video Streaming Methodology

The rate adaptation controlling methodology, TCP-friendly rate control techniques for streaming services over mobile networks are proposed, where TCP protocol throughput of a flow is predicted as a function of packet losses rate and packet size. Considering the calculated throughput, the bit rate of the video streaming traffic can be adjusted. A bit rate adaptation algorithm for conversational 3G or 4G video streaming and a few cross-layer adaptation techniques are discussed, which can acquire more accurate information of link quality so that the rate adaptation can be more accurately made. Anyhow, the servers have to always control and thus suffer from large workload.

Recently the H.264 Scalable Video Coding (SVC) methodology has gained a momentum. An adaptive video streaming system based on SVC is structured, which studies the real-time SVC decoding and encoding at PC servers. The work in proposes a high quality-oriented scalable video coding delivery using SVC, but it is only tested in a simulated 3G, 4G and LTE network. Regarding the encoding performance of SVC, Cloud Stream mainly proposes to provide high-quality streaming videos through a cloud-based SVC proxy, which discovered that the cloud computing can significantly improve the performance of SVC coding.

B. Mobile Cloud Computing Methodology

The cloud computing has been well pointed to deliver the video streaming services, especially in the wired Internet because of its scalability and Adaptability. For example, the high quality-assured bandwidth auto-scaling for Video streaming based on the cloud computing, and the CALMS framework is a cloud-assisted live media streaming service for globally distributed users. But, extending the cloud computing-based services for mobile environments requires more factors to consider: wireless link dynamics, user mobility, the limited computing capability of mobile devices. More recently, new designs for users on top of mobile cloud computing environments are proposed, which virtualized private agents that are in charges of satisfying the requirements of individual users.

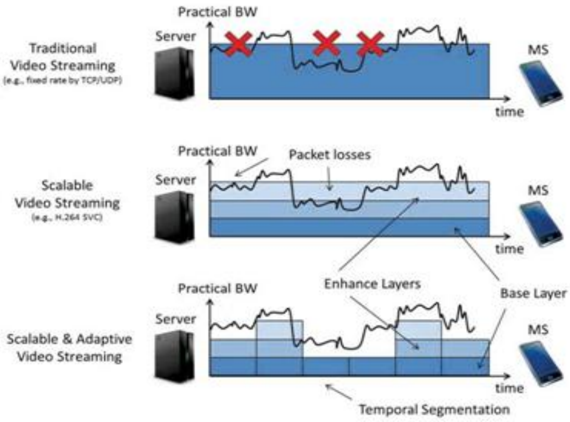
We propose an efficient mobile video streaming and sharing framework, called EMVS-Cloud, which is effectively store the videos in the clouds (VC), and provides cloud computing to construct private agent (subVC) for each mobile device user to try to provide "non-terminating" video streaming adapting to the facing problem of link quality based on the Scalable Video Coding methodology. Also EMVS-Cloud can able to provide "non-buffering" experience of video streaming by background pushing functions among the VB, subVBs and localVB of mobile users. We evaluated the EMVS-Cloud by prototype implementation and shows that the cloud computing technique brings significant improvement on the mobile video streaming.

III. Results and Tables

The entire video Streaming and Sharing system in the cloud is called the Video Cloud (VC). In the VC, there is a big-scale video base (VB), which stores the popular video clips for the video service providers (VSPs). A temporal video base (tempVB) is used to pick up new candidates for the best videos, while tempVB counts the access level frequency of each and every video. The VC keeps getting a collector to search videos which are already popular in VSPs, and it will re-encode the fetched videos into SVC format and sharing into tempVB first. By this 2-tier storage, the EMVS-Cloud can keep serving most of popular videos eternally. Note that management work will be handled by the controller in the VC.

Specialized for each mobile device user, a sub-video cloud (subVC) is created automatically if there is any video streaming demand from the mobile user. The sub-VC has a sub video base (subVB), which stores the recently retrieved new video clips. Note that the video distributes among the subVCs and the VC in most cases are actually not to "copy", but just "link" activation on the same file eternally within the cloud data environment. There is also encoding function in subVC (actually a smaller-scale encoder instance of the encoder in VC), and if the mobile device user demands a new video files, which is not presented in the subVB or the VB in VC, the subVC will retrieve, encode and transfer the video. During video streaming, mobile device users will always report link conditions to their corresponding subVCs, and then the subVCs offer efficient video streams. Note that each mobile device also has a temporary data caching storage, which is called as local video base (localVB), and is used for buffering and fetching.

Note that as the cloud environment may across different location, or even continents, so in the case of a video delivery and fetching between different data centers, an transmission will be carried out, which can be then called "copy". And because of the optimal deployment of data centers, as well as the capable links among the cloud data centers, the "copy" of a large video files takes tiny delay.



IV Algorithm

Matching Algorithm between BW and Segments

i = 0
*BW*0 = *RBL*
Transmit *BL*0
Monitor *BWpractical*
0
repeat
Sleep for *Twin*
Obtain *pi*, *RTTi*, *SINRi* etc., from client's report
Predict *BWestimate*
i+1 (or *BWestimate*
i+1 = *BWpractical*
i)
k=0
BWEL=0
repeat
k++
if *k* >= *j* break
BWEL=*BWEL* + *RELk*
until *BWEL* >= *BWestimate*
i+1
□ *RBL*
Transmit *BLi*+1 and *EL*1
i+1, *EL*2
i+1,..., *ELk*□1
i+1
Monitor *BWpractical*
i+1
i++
until All video segments are transmitted

We classify the social activities in current popular SNSs into three kinds, regarding the impact of the activities and the potential reacting priority from the point of view of the recipient:

Subscription: Like the popular RSS services, an user can subscribe to a particular video publisher or a special video collection service based on his/her interests. This interest-driven connectivity between the subscriber and the video publisher is considered as "median", because the subscriber may not always watch all subscribed videos.

Direct recommendation: In SNSs, an user directly recommend a video to particular friend(s) with a short message. The recipients of the message may watch it with very high probability. This is considered as "strong".

Public sharing: Each user in SNSs has a timeline-based of activity stream, which shows his/her recent activities. The activity of a user watching or sharing a video can be seen by his/her friends (or followers). We consider this public sharing with the "weak" connectivity among users, because not many people may watch the video that one has seen without direct recommendation.

IV. Conclusion

In this paper, we discussed our proposal of an efficient mobile video streaming and sharing framework, called EMVS-Cloud, which efficiently stores videos in the clouds center (VC), and utilizes cloud computing to create private agent (subVC) for each mobile device user to try to provide "non-terminating" video streaming adapting to the facing problem of link quality based on the Scalable Video Coding methodology. Also EMVS-Cloud can able to provide "non-buffering" experience of video streaming by background pushing operation among the VB, subVBs and localVB of mobile device users. We evaluated the EMVS-Cloud by prototype implementation and shows that the cloud computing technique brings efficient improvement on the adaptivity of the mobile video streaming. The focus of this paper is to verify how cloud computing can able to improve the transmission adaptability and pre-fetching for mobile device users. We ignored the cost of encoding workload in the cloud while implementing the prototype. As one important future work, we will carry out large-scale implementation and with serious consideration on energy and price cost. In the future, we will also try to improve the SNS-based pre-fetching, and security issues in the EMVS-Cloud.

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