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User Behaviour Prediction Based Mobile Video Streaming and Sharing With Adaptive Policy Pre-fetching in the Cloud

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Abstract—The mobile devices become a necessary part of our daily life, with smart phone sales now increased very much and also end-user demands to run many applications has increased. Recent advances in the mobile video streams over mobile networks have been souring over these new trends, the wireless link capacity not practically support with the increasing traffic demand. The hole among the traffic load and the wireless link capacity, along with time-changeable link situations, results in reduced quality of mobile video streams over mobile networks, such as extended buffering delays and intermittent disruptions. Leveraging the recent cloud computing technology, we suggest a framework to get better quality of video services for the mobile users, which contains of two parts: A newly distributed web User Behaviour Prediction model (DUCP) is introduced to cognize and predict user behaviour sensing and the prediction provided by DUCP, further Adaptive Policy Pre-fetching and Caching method (APPC) is addressed for efficient cloud management. We apply a prototype of DUBP framework model to demonstrate the performance. For every lively mobile user, DUBP lets construct a private agent in the cloud data centre to adjust the video streams flow (bit rate) by the scalable video coding technique based on the response of link quality from the mobile user. Likewise, APPC monitors the social network connections among users, and their cloud based on the private agents try to prefetch video content in advance. It is exposed that the private agent in the clouds can effectively provide the adaptive mobile video streaming and perform the video prefetching based on the social network analysis.

Index Terms—Cloud Computing, Adaptive mobile video streaming, Scalable video coding, Mobile networks.

I. INTRODUCTION

Mobile cloud computing have become wider range of applications offered to mobile users away from conventional office applications by supporting hardware, 3D virtual environments, and large storage capacity, also users share the cloud infrastructure, This technology can offer these hardware resources cost-effectively [1]. Above the past decade, more amount of traffic delay is accounted by mobile video streaming and downloading of videos owing to fast development of mobile networks, many people are attracted to the video streaming services on mobile Phones and tablets whereas travelling in buses, cars and trains. In particular, video streams over mobile networks become widespread over the past few years. In spite of the network operators desperate hard to enhance the wireless link bandwidth (e.g., 3G and 4G), high video traffic load from mobile users are quickly overpowering the wireless network capacityWhereas the video streaming is not difficult in wired networks, but the mobile networks suffering from video traffic delay transmissions over inadequate bandwidth of wireless networks. As a result, it is crucial to get better service quality of mobile video streams though using the networking and computing resources of mobile. Whereas getting the video streams via 3G/4G mobile networks, mobile users are frequently suffer from intermittent disruptions and time-consuming buffering delays owing to the inadequate bandwidth and link state fluctuation by user mobility and multi-path fading The researchers are looking into the factors of Quality of Service for mobile video streams and design new technique for attain improved performance [4]. Recently a lot of study proposed and how to increase the service quality of mobile video streams of mobile network

II. RELATED WORK

A. Adaptive mobile video streaming with little disruption

1) Adaptability**:** The conventional mobile video streams are designed under the constant internet links, among users and servers and thus may perform weakly in mobile environments; with a particular bit rate, if the wireless link bandwidth various such, the mobile video streams can be regularly disrupted due to packet loss and bandwidth waste. For an improved QoS experience, the fluctuating link conditions have to be correctly handled for provide “stable” mobile video services by which the video quality can adjust to the environment. To deal with this concern, we need to adjust the video bit rate adapting to the time-altering accessible wireless link capacity for every mobile user, based on their feedback of the link conditions. So the fluctuating link positions have to be correctly contract with to offer “tolerable” mobile video streams. Adaptive video streaming and scalable video coding techniques can be combined to achieve effectively the greatest quality of mobile video streams. So as to, we can dynamically change the number of SVC layers

depending on the present link position. The most of the suggestion seeking to combine to utilize the mobile video scalability and adaptability rely on the server side. All mobile users want to separately report the transmission position at regular intervals to the server, which monitors the obtainable bandwidth for every user. Therefore the difficulty is that server must take over the large processing overhead, as the number of mobile users increases.

2) Scalability: The mobile video streams should hold up a large spectrum of mobile phones, with various video screen resolutions, different range of powers system and dissimilar wireless link accesses (e.g., Wi-Fi, 3G and 4G). Still, the conventional method store many versions (with various bit rate) of the identical video content may incur tremendous storage more than your head whereas the volume of video content space rocket globally. Also, the obtainable wireless link capacity of mobile may vary over certain time and space depending on signal power, other user traffic load in the same cell, and link state deviation. To focus on this problem, the Scalable Video Coding technique of the H.264 AVC video compression standard describes a base layer (BL) with many enhancement layers (ELs). The sub streams can be divided into following features: (i) spatial scalability by layering screen pixels, (ii) temporal scalability by layering frame rate, and (iii) quality scalability by layering image compression. The formation of the elastic cloud computing technique, its openly providing scalable resources to comfortable and service providers on the recent user demands .Though, we extending the cloud computing based services to mobile networks requires many factors to be consider: wireless link dynamics, storage space, limited power supply of mobile devices [18], inadequate computation, and user mobility. In the mobile cloud computing, many instances of private user agents can be maintained with dynamism and capably depending on the time-changing user load. So, we are enthused to design a new framework of distributed web User Behaviour Prediction model for adaptively adjust mobile video streams by using virtual agents in the cloud.

B. Intelligent video streaming with small buffering load

In order to decrease the buffering delay, the intellectual prefetching, which pushes a piece of the video file into the mobile devices before user basically access, is greatly needed. Towards this observe, a new development to exploit the Social Network Services for intellectual mobile video prefetching is attractive and more popular. Since the dramatic increase in the number of users who contribute in the SNSs, e.g., Face book, Twitter, and so on, vast amount of video content is shared and spread quickly and widely in the SNS. We indicate the following three key points which can be utilized for intellectual approaching:

1) Locality: User dealings and interest in SNSs contain important homophile and area properties. Mobile users are very much clustered by environmental regions and importance, which can be exploited for intellectual approaching for the best provision of cloud resource.

2) Social Impact: In this real world in addition to the online SNS, people frequently share important content owing to "word-of-mouth" broadcast. A user may possibly to watch a video that friends have suggested. An official Face book or Twitter account that shares the latest popular music, videos, which are to be watched by the follower fans.

3) Access Delay: Various mobile users contain changed patterns of accessing videos from the cloud [11], which are every-user dependent mostly owing to people life styles. Some users may access videos regularly, whereas others can access videos in longer intervals.

III. A FRAMEWORK OF USER BEHAVIOUR BASED ADAPTIVE MOBILE VIDEO SERVICES

In this paper, we will study and deal with the upcoming techniques for user behaviour based adaptive mobile video services, which build private agents for lively users in the mobile cloud, so as to suggest "non-terminating" and "non-buffering" mobile video streams to the mobile users. The private

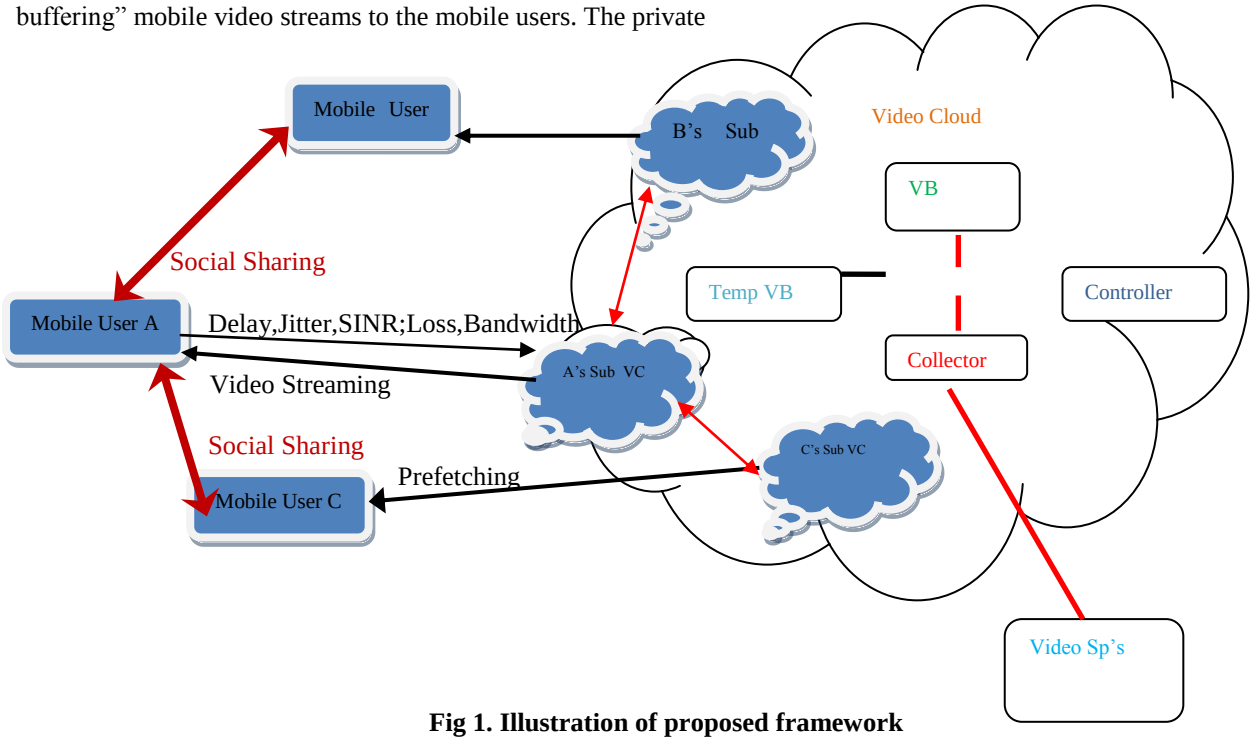

Fig 1. Illustration of proposed framework

agents are elastically initiated and optimized in the cloud environment. Moreover the real-time SVC coding created on the cloud side efficiently. Our proposed framework leverages the SVC technique offers the scalable and adaptive mobile video streams by scheming the mixture of video streaming (layers) based on the fluctuating link condition from the mobile users on the basis of user needs and monitoring the link status on the basis of user activity depends on the user where interact with their friends many ways. The power of the social links among mobile users in the framework and the history of social actions can determine which video and how much prefetched. We classify the paper as follows: first explain the cloud private agent framework and provides details of user behaviour based adaptive mobile video streaming and adaptive policy prefetching and caching method is addressed for efficient cloud management. Then the short delivery Process is exposed, and we talk about performance assessment of our proposal.

IV. CLOUD AGENT FOR MOBILE USERS

As shown in Fig. 1, the entire video storing and streaming of videos in the cloud is called the Video Cloud (VC). In the VC, there is a huge Video Base (VB), which stores recent popular video clips from the video service providers (VSPs). A short-term Video Base (temp VB) is used to cache new candidates for trendy videos. The VC also keeps running a collector to explore for popular videos from the VSPs, and re-encode the collected videos into SVC design and store into temp VB. In particular for every lively user, a sub-Video Cloud (sub VC) formed with dynamism since there is any video streams require from the mobile user. Every sub-VC has a sub-Video Base (sub VB), which stores all the freshly fetched video segments. The video deliveries between the sub VCs and the VC in numerous cases are really not "copy" but just "link" operations of the similar file forever within one cloud data centre. Even some cases videos are copied from one data centre to another, it will be very fast. During the mobile video streaming, users will always occasionally report wireless link conditions to their resultant sub VCs, and then make prediction of the accessible bandwidth of next time window and correct the grouping of BL and ELs adaptively.

V. USER BEHAVIOUR PREDICTION ADAPTIVE MOBILE VIDEO STREAMING

The conventional adaptive mobile video streaming frameworks, e.g., Apple's HTTP adaptive live streaming solutions, Microsoft's smooth streaming technique, encompass to keep numerous copies of the video content with various bit rates, and thus bring vast burden of storage to the server. So the new H.264 Scalable Video Coding (SVC) has to gained lots of attentions. SVC defines varied profiles of mobile video streams with one base layer (BL) and multiple enhancement layers (ELs). The concurrent SVC encoding and decoding on PC servers is studied. As well the work has deployed in the cloud-based SVC alternative has exposed that the cloud computing can extensively improve the performance of SVC coding. Other power of mobile cloud based SVC encoding is that, once user has demand to encode a video by a sub VC, the encoded segments of layers will be intelligent to re-used between sub VCs, and as a result user don't want to request to re-encode the video streams. When the mobile user energetically initializes to stream a video, cloud agent will be agent be quickly widespread for that mobile user. The mobile client stay tracks on metrics, including signal power, packet round-trip-time (RTT), bandwidth and packet loss, under certain duty cycle.

VI. EFFICIENT SOCIAL VIDEO SHARING CONTENTS

Inside SNSs, users can subscribe to identify well-known people, friends, and particular content publishers; in addition there are different types of social actions between users in SNSs. It is used for sharing of videos in SNSs, individual can able to post videos in public, and they subscribe to capable of fast see it; one who know how to directly suggest a video to particular friend(s); in addition one can regularly get noticed by subscribed content publisher for new or accepted videos. The video can be posted by one user may watched by the many recipients of their membership activities, so that sub VCs can bring out winning background prefetching at the sub VB and still may drive to users local VB. After a video sharing action, there might be a certain amount of delay that the recipient gets to be familiar with the sharing, and initiates to watch videos. As an alternative, a user can able to click to see the videos without several buffering delay as the opening part or even the entire video is prefetched locally in VB. The prefetching from VC to sub VC is simply refers to the "connecting" action, so there is only file locating and connecting operations with little delays; the prefetching from sub VC to local VB depends on the strength of social activities, but also consider the wireless link status.

1) Public sharing: The movement of watch or share a video by a user can be seen their friends in their timeline of action stream. We think this public sharing as a "weak" connectivity between users, as many people may not watch the video that one has watched or shared with any specific suggestion.

2) Subscription:

Similar to the popular RSS services, a user can subscribe an interested video based on their needs. This is connectivity among the subscriber and the video publisher is consider as "median", because the user not watch all subscribed videos.

3) Direct recommendation: A user can directly recommend a video to friends by a short message. The recipients of message may watch it high resolutions.

VII. ADAPTIVE POLICY PRE-FETCHING AND CACHING

Based on user behavior sensing and prediction provided by DUBP, a further Adaptive Policy Pre-fetching and Caching scheme (APPC) is addressed in this section for fine-grained and efficient network management. Once a record (i.e. *record*(*i*)) arriving at LCA(*k*), it will trigger the LCA(*k*) executing some steps as follow immediately:

a) Uses <CNID, DIP, DPort> to obtain the total matched URL counts (denoted as $Count_{Existing}$) .

b) Inquires the specified URL counts (denoted as $Count_{Specified}$) which is set by administrator in web console.

1) Reinforcement Learning(RL)*:* RL is learning what to do-how to map situations to actions, so as to maximize a numerical reward signal. A RL Agent learns knowledge via interacting with the Environment. That is, once the Agent changes its state from one to another, a reward will be returned the environment. From the rewards, the Agent will learn a policy how to gain a more benefit rewards.

VIII. CONCLUSION

Our proposal of the user behaviour prediction based mobile video streaming and social video sharing which efficiently stores and retrieve videos from the cloud to construct private agent for active mobile user try to watch "non-terminating" mobile video streaming by adjust based on the user behaviour. This computing technique brings significant improvement to the mobile adaptability and scalability. Regarding the future work, we will carry out large-scale implementation on energy and price cost on the basis of mobile users. Also we try to extend our framework with more concerns of security and privacy. The focus of this paper is to verify how cloud computing can improve the transmission adaptability and pre-fetching mobile users. The performance of the AMES-Cloud and User Behaviour Prediction based Pre-fetching frameworks are implemented. We compare the results of both existing and proposed system with Relative errors between predicted bandwidth and practical bandwidth (percentage), Evaluation of SVC resolution schemes, Pre-fetching Delays and Watching Delay.

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