ISSN No. 0976-5697

Volume 5, No. 5, May-June 2014

International Journal of Advanced Research in Computer Science

CASE STUDY AND REPORT

Available Online at www.ijarcs.info

Survey on Video Streaming and Sharing in Cloud

Ajimon Siji
M.Tech, CSE Dept.
Viswajyothi College of Engineering and Technology
Vazhakulam, Ernakulam,India

Amel Austine
Asst. Professor, CSE Dept.
Viswajyothi College of Engineering and Technology
Vazhakulam, Ernakulam,India

Abstract: Cloud computing is an emerging field in today's world. With the advent of technology, there is a tremendous increase in mobile users and according to several surveys increase in video consumption. Several issues related to video streaming and sharing is discussed. Along with this, AMES-Cloud, a cloud based adaptive video streaming technology in mobile network that also provides for efficient video sharing is introduced briefly.

Keywords: Cloud computing; Video Streaming; Social Video Sharing; SVC Coding.

I. INTRODUCTION

During the early stages of technology, the term 'data' usually referred to documents, texts, numbers etc. Later the prominence got shifted to images and then to video and audio data. In today's world, video data is of utmost importance in a majority of applications. Another major advent in technology was that of the concept of mobility. The introduction of mobile devices and the emergence of mobile computing as a new and diverse area led to even more advancements and introduction of new technology. Transfer of data, and then video and audio presented new challenges. But video streaming is popular among the mobile users. Recent surveys show that increase in mobile users and video sharing can increase tenfold in the coming years.

The increase in mobile users has led to an outburst in mobile traffic over the past few years. Of this video streaming in general and mobile video streaming in particular faces a lot of issues and challenges. This is because of many reasons. This problem is gaining importance because of the predictable increase in mobile users in the coming years and the increase in users uploading or downloading mobile content.

Cloud computing is an emerging area of technology that provides users with new technologies having the advantages of 'pay-per-use', being flexible etc. According to [2] Cloud computing is a type of computing that relies on sharing computing resources rather than having local servers or personal devices to handle applications. The word cloud may refer to "the Internet," and the phrase cloud computing can refer to "a type of Internet-based computing,". Cloud can provide different services such as servers, storage and applications.

When the storing and streaming of data gets upgraded to a Cloud environment, it faces some new issues and challenges as well. Since the services in Cloud must provide the obvious advantages like flexibility, video streaming must be designed and implemented such that the end user gets an efficient result.

This paper provides a detailed survey about the mobile video streaming and social video sharing in cloud. The survey is divided into 3 parts. Section II is an introductory part, which introduces some recent surveys in the area of mobile networks in general, media content consumption, mobile internet TV system etc. Section III introduces SVC coding which plays an important role in video streaming. In section IV some studies related to adaptive video streaming is done and an efficient framework that incorporates both adaptive video streaming and social video sharing is introduced.

II. SURVEY

A. On Global Mobile Traffic:

Cisco Visual Networking Index (VNI) forecast research is an ongoing initiative to predict global traffic growth [3]. They focus on consumer and business mobile data traffic and its key drivers. The Global Mobile Data Forecast Update published in 2013, showed some crucial results regarding the data traffic growth across the world.

In the half a billion new mobile devices and connections added in the year 2013, Global mobile data traffic grew 81 percent in 2013. According to this survey Last year's mobile data traffic was nearly 18 times the size of the entire global Internet in 2000. This means that if 1 exabyte of traffic was traversed the global Internet in 2000, in 2013 mobile networks carried nearly 18 exabytes of traffic. By 2018, global mobile data traffic will reach an annual run rate of 190 exabytes per year (nearly 11-fold growth). This means 190X more IP traffic generated in 2000, 42 Trillion images (e.g., MMS or Instagram) and 4 Trillion video clips (e.g., YouTube)

Data traffic in general, and mobile video traffic in particular showed high increase rate in the previous years. For instance, Mobile video traffic exceeded 50 percent for the first time in 2012. Mobile video traffic was 53 percent of traffic by the end of 2013. The mobile data traffic impact is shown graphically by CISCO in figure 1 [3].

B. On Global Mobile Internet TV Systems:

In [4], the authors give a detailed and comprehensive analysis of the impact of mobile TV internet systems and their impact in today's world

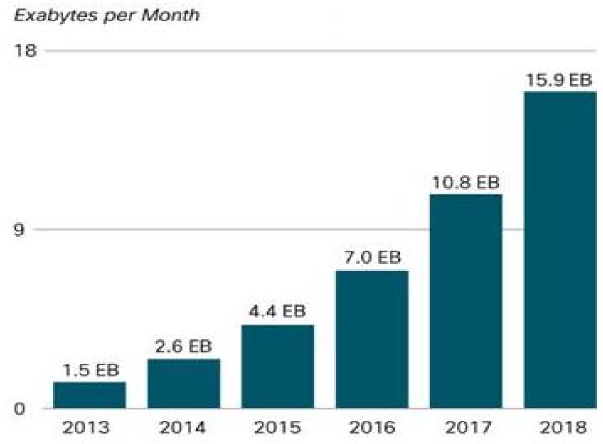

Figure 1. Data Traffic Impact – CISCO

Growth of Internet video applications and the proliferation of mobile smart phones have made it possible to provide live streaming TV content to mobile users. Mobile TV is an emerging application over mobile networks. These also allow to collect traffic data and analyzing user behaviors. According to this survey, from the large amount of data collected from both the video streaming servers and the mobile device clients, some conclusions and analysis were drawn. The most important among them was that both 3G networks and WiFi networks have adequately supported the video viewing experience. Greater than 95% of video playback is continuous and the vast majority of startup delays are within 10 seconds. Although the user population evolution is similar to that of the landline based IPTV, the exact time of peaks are different with a strong night- time peak and a smaller peak during the lunch break. The channel popularity is found to be highly skewed and follows a Pareto distribution, with a dropped tail. However the HTTP Live Streaming protocol uses a different manner on video data transmission compared with traditional video streaming protocols. The protocol has a major disadvantage was that when the video segments are being downloaded, the link bandwidth would be nearly 100% occupied. However during the intervals between successive segment downloads, the link would most likely be idle. It is possible that buffering may prevent playbacks from stuttering even if some segments do not arrive in time.

C. On Media Content Consumption in Social Networks:

Social network is a pervasive instrument of information consumption and production. They have become one of the best tools to share and consume information in many different content formats. A survey done in 2007 [5] analyses how the different content formats and their sources influence social network's usage. The results show that the importance of different media types is perceived differently depending on whether users are producing of consuming media. They also show that different sources of content are given different importance by Facebook users, and that sources also impact the importance of the media type of the information consumed.

For instance according to a survey [5] done on 148 Facebook users establishes an initial characterization of media consumption and sharing habits. Mobile devices represent 40% of the devices used for accessing Facebook. This led to the conclusion that solutions targeting Facebook usage, considering specifically media content consumption or not, should be aware that there is a large possibility that content will be consumed in a mobile device.

The survey also found that people gave different importance to different. For instance, text posts are the most common when sharing information, but image posts are the most frequent when consuming content. Another significant observation was that content posted by friends was given higher importance than that posted by family or Facebook pages. This importance given to media type for each possible sources of content was a significant factor. The preference is more pronounced when posts originate from a family member than when a friend is the origin. This survey also shows that video and image media are more important to Facebook users than text even though importance varies with the content's source.

III. SVC AND SVC BASED IMPLEMENTATIONS

A. SVC Extension of H.264/AVC Standard:

With the introduction of the H.264/AVC video coding standard, significant improvements have recently been demonstrated in video compression capability. The Joint Video Team of the ITU-T VCEG and the ISO/IEC MPEG has standardized a Scalable Video Coding (SVC) extension of the H.264/AVC standard. Details about this are given in [6].

According to [6], SVC provides functionalities such as graceful degradation in lossy transmission environments as well as bitrates, format, and power adaptation. These functionalities provide enhancements to transmission and storage applications. SVC has achieved significant improvements in coding efficiency with an increased degree of supported scalability relative to the scalable profiles of prior video coding standards.

Scalable Video Coding (SVC) is an efficient solution to the problems posed by modern video transmission systems. In comparison to prior video coding standards, the H.264/AVC extension for SVC provides various tools for reducing the loss in coding efficiency relative to single layer coding. The main advantage is the possibility to employ hierarchical prediction structures for providing temporal scalability with several layers while improving the coding efficiency and increasing the effectiveness of quality and spatial scalable coding. Inter-layer prediction of motion improves the coding efficiency of SVC.

B. Real Time System Application Based on SVC:

Reference [7] is a real time system application based on SVC mainly for the purpose of adaptive video streaming. This has some added functionalities that include encoding, error protection, adaptation, and decoding.

The architecture of the proposed scheme [7] is as shown in figure 2. There are 3 components in the architecture: a client,a server and, in between, an adaptation node. The client collects user context and requests multimedia content to the adaptation node. The adaptation node relays the media requests to the server(or another adaptation node), receives and adapts the media units and finally sends them to the client. The server fulfills requests from the adaptation node by reading media packets and metadata from either a storage area or from a live encoder that produces scalable media packets and associated metadata.

Figure 2 shows the usage of a live encoder integrated with the server. The audio visual stream is multicasted to the adaptation node that relays it with specific adaptation parameters to multiple clients through unicast connections.

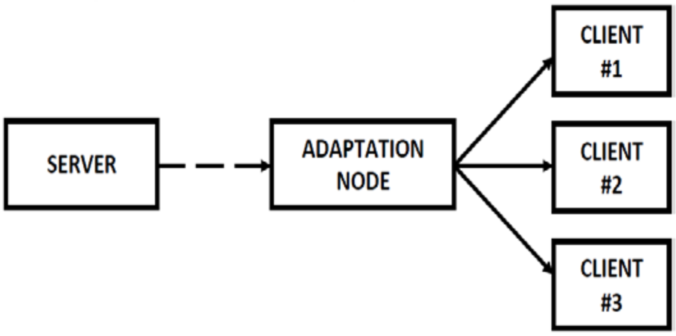

Figure 2. Architecture for live encoding and transmission of SVC video.

IV. ADAPTIVE VIDEO STREAMING – RELATIVE STUDIES

A. *Scalable Video Delivery on an LTE Network:*

Over the years, cellular networks have experienced an increased demand for multimedia-based communications. According to [8] this was largely due to the increase in bandwidth in evolving cellular wireless technologies like LTE and WiMAX. Service and network providers are exploring the opportunity to further enhance their current offerings. One of their area of interest is catering for the demand in rich multimedia services to both mobile and fixed users using cellular networks such as LTE.

It was further observer that the loss of packets causes different quality degradation over the time according to which packet has been lost.

As per the simulations in [8], a high packet corruption can lead to application layer loss events on the time scale of seconds or minutes. They [8] have also noted that Cloud computing is redefining the way many Internet services are operated and provided, including Video-on-Demand (VoD). Instead of buying racks of servers and building private data centers, it is now feasible for VoD companies to use computing and bandwidth resources of cloud service providers. This, as the authors of [8] believe, could lead to many drastic changes in this area.

B. *On Video-on-Demand Applications:*

'Quality Assured Cloud Bandwidth Auto Scaling for Video – on – Demand Applications' [9] takes into consideration the recent trend on video-on-demand (VoD) applications especially in Cloud. In [9] they note that one of the most important economic appeals of cloud computing is its elasticity and auto-scaling in resource provisioning. After careful capacity planning, an enterprise usually makes long-term investments on its infrastructure to accommodate its peak workload. However, utilization remains low during most non-peak times. In contrast, in the cloud, the number of computing instances launched can be changed adaptively at a fine granularity with a lead time of minutes. As the cloud's auto-scaling ability enhances resource utilization by matching supply with demand, overall expenses of the enterprise may be reduced.

VoD users must download at a rate no smaller than the video playback rate to smoothly watch video streams online. Thus bandwidth, as opposed to storage and computation, constitutes the performance bottleneck. A major obstacle that prevents numerous VoD providers from embracing cloud computing is that, unlike CPU and memory resources, a guarantee of bandwidth is not provided in current cloud services. Instead, each data center has limited outgoing bandwidth shared by multiple tenants with no bandwidth assurance.

However, according to [9] a number of important challenges need to be addressed to achieve bandwidth auto-scaling for a VoD provider. First, since resource rescaling requires a delay of at least several minutes to update configuration and launch instances, it is best to predict the demand with a lead time greater than the update interval, and scale the capacity to meet anticipated demand. Such a proactive, rather than passive, strategy for resource provisioning needs to take into account demand fluctuations in order to avoid bandwidth insufficiency. Second, as statistical multiplexing can smooth traffic, a VoD provider can reserve less bandwidth to guard against fluctuations by jointly reserving bandwidth for all its video channels. However, to serve geographically distributed end users, a VoD provider usually has its collection of channels served by multiple data centers, which are possibly owned by different cloud providers.

The overall system architecture is shown in Figure 3. This architecture proposed by [9] comprises mainly of three key components. These are bandwidth usage monitor, demand predictor and load optimizer. Bandwidth rescaling happens proactively everyΔt minutes, with the following three steps:

First, before time t, the system collects bandwidth demand history of all channels up to time t, which can easily be obtained from cloud monitoring services.

Second, the bandwidth demand history of all channels is fed into the demand predictor to predict bandwidth requirement of each video channel in the next t minutes, i.e., in the period [t, t + Δt). The predictor not only forecasts the expected demand, but also outputs a volatility estimate, which represents the degree that demand will be fluctuating around its expectation, as well as the demand correlations between different channels in this period.

Finally, the load optimizer takes predicted statistics as the input, and calculates the bandwidth capacity to be reserved from each data center.

This paper [9] gives a detailed idea about the effect of VoD applications in Cloud computing and proposes an effective architecture (figure 3) for reserving bandwidth.

V. AMES CLOUD

While demands on video traffic over mobile networks have been souring, the wireless link capacity cannot keep up with the traffic demand. The gap between the traffic demand and the link capacity, along with time-varying link conditions, results in poor service quality of video streaming over mobile networks, long buffering time and intermittent disruptions. Leveraging the cloud computing technology, a new mobile video streaming framework, named AMES-Cloud [1] is proposed,

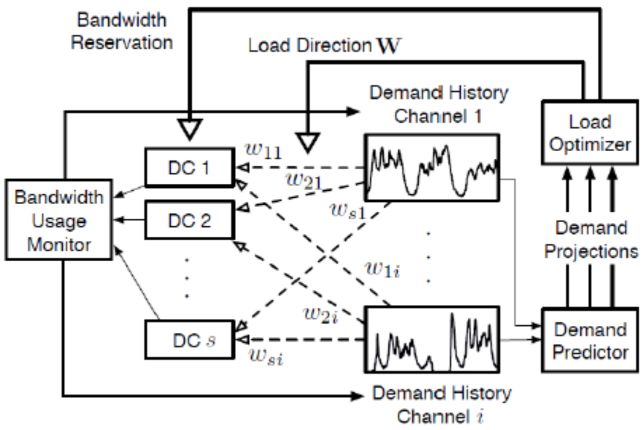

Figure 3. System Architecture for a VoD Application as given in [9].

Which has two main parts: adaptive mobile video streaming (AMoV) and efficient social video sharing (ESoV). AMoV and ESoV construct a private agent to provide video streaming services efficiently for each mobile user. For a given user, AMoV lets the private agent adaptively adjust streaming flow with a scalable video coding technique based on the feedback of link quality. Likewise, ESoV monitors the social network interactions among mobile users, and their private agents try to prefetch video content in advance.

The contributions of this project can be summarized as follows. AMoV offers the best possible streaming experiences by adaptively controlling the streaming bit rate depending on the fluctuation of the link quality. AMoV adjusts the bit rate for each user leveraging the scalable video coding. The private agent of a user keeps track of the feedback information on the link status. Private agents of users are dynamically initiated and optimized in the cloud computing platform. AMES-Cloud supports distributing video streams efficiently by facilitating a 2-tier structure: the first tier is a content delivery network, and the second tier is a data center. With this structure, video sharing can be optimized within the cloud. Unnecessary redundant downloads of popular videos can be prevented. Based on the analysis of the SNS activities of mobile users, ESoV seeks to provide a user with instant playing of video clips by prefetching the video clips in advance from her private agent to the local storage of her device. The strength of the social links between users and the history of various social activities can probabilistically determine how much and which video will be prefetched.

VI. CONCLUSION

The survey covers video streaming and social video sharing techniques that are used in a variety of applications. Throughout the paper the need for a better video streaming application is outlined. A comprehensive framework dubbed 'AMES-Cloud' is then introduced and explained.

VII. ACKNOWLEDGMENT

The authors would like to thank the staff and students of Computer Science And Engineering Department and the management of Viswajyothi College Of Engineering And Technology, Vazhakulam, India for their continued support and guidance.

VIII. REFERENCES

[1] Xiaofei Wang, Min Chen, Ted Taekyoung Kwon, Laurence T. Yang and Victor C.M. Leung, "AMES-Cloud: A Framework of Adaptive Mobile Video Streaming and Efficient Social Video Sharing in the Clouds", IEEE Transactions on cloud computing vol:15 no:4 year 2013.

[2] Definition for Cloud Computimg – Internet url: http://www.webopedia.com/TERM/C/cloud_computing.htht.

[3] "Cisco Visual Networking Index (VNI) Global and North America (NA) Mobile Data Traffic Forecast Update 2013-2018", February 2014.

[4] Yuheng Li , Yiping Zhang and Ruixi Yuan, "Measurement and Analysis of a Large Scale Commercial Mobile Internet TV System" , ACM IMC 2011.

[5] José Coelho, Gonçalo Gomes, Eduardo Matos and Carlos Duarte "A Survey About Media Content consumption in Social Network Platforms" , Academia.edu 2013

[6] Heiko Schwarz and Detlev Marpe 'Overview of the SVC Extension of the H.264/AVC Standard' , IEEE Transactions On Circuits And Systems For Video Technology 2007.

[7] Mathias Wien, Renaud Cazoulat, Andreas Gra□under, Andreas Hutter, and Peter Amon "Real-Time System for Adaptive Video Streaming Based on SVC", IEEE Transactions On Circuits And Systems For Video Technology 2007.

[8] Patrick McDonagh, Carlo Vallati, Amit Pande, Prasant Mohapatra, Philip Perry and Enzo Mingozzi "Quality-Oriented Scalable Video Delivery using H.264 SVC on an LTE Network" , IEEE INFOCOM 2012.

[9] Di Niu, Hong Xu, Baochun Li , and Shuqiao Zhao "Quality-Assured Cloud Bandwidth Auto-Scaling for Video-on-Demand Applications" ,WPMC 2011.

