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RESEARCH ARTICLE

Development and Evaluation Mobile Multimedia Cloud Application

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Abstract ***Multimedia on phones is a rapidly growing segment, and almost every mobile user would have a perceived need for a multimedia-based entertainment application. The size of the worldwide mobile video market was comprised of 429 million mobile video users in 2011, projected to grow exponentially to 2.4 billion users by 2016. Smartphones and tablet sales will contribute 440 million new mobile video users during the forecast period. [1]. However, in spite of advances in the capabilities of mobile devices, a gap will continue to exist, and may even widen, with the requirements of rich multimedia applications. Mobile cloud computing can help bridge this gap, providing mobile applications the capabilities of cloud servers and storage together with the benefits of mobile devices and mobile connectivity. Proposed model demonstrates the applicability of emerging cloud computing concepts for mobile multimedia. This model uses cloud for storage and content management of multimedia content (e.g. video data) across various devices like desktop and mobile devices. This paper also compares proposed model with other types of mobile multimedia applications which are not using cloud resources.***

Keywords**—** *Multimedia, cloud computing, streaming, mobile devices, data storage*

I. Introduction

Mobile devices (e.g., 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. The widespread use of smartphones and other mobile devices contributes to unprecedented sharing of mobile multimedia on social networking sites like Facebook or streaming on web sites like YouTube. Additionally, web and mobile multimedia converge, as the mobile networks become an integral part of the Internet. However, with mobility come its inherent problems such as resource scarceness, finite energy and low connectivity. High quality Mobile multimedia applications demand intensive computing resources. In recent years, this problem has been addressed by researchers though cloud computing by development of mobile cloud apps. Besides storage and download services, a big boost to mobile consumer cloud services has come from a major shift in the mobile applications market, from primarily native applications to ones based on mobile cloud computing: utilizing the computing and storage resources available in the cloud, thereby enabling the use of cutting edge multimedia technologies that are much more computing and storage intensive than what mobile devices can offer, and thus enabling much richer media experiences than what current native applications can offer[2]. While according toMarketsAndMarkets.com, the global mobile applications market is expected to be worth $25.0 billion by 2015 [3], use of mobile cloud computing will enable more powerful applications, and hence more significant growth. And finally, mobile cloud computing based applications can simultaneously avail of not only cloud resources, but also the unique resources of mobile devices, like user location and device sensors, that will make such applications more powerful than either server or PC-based applications, or current native mobile applications.

A. Mobile Cloud Computing

"Mobile Cloud Computing at its simplest refers to an infrastructure where both the data storage and the data processing happen outside of the mobile device. Mobile cloud applications move the computing power and data storage away from mobile phones and into the cloud, bringing applications and mobile computing to not just smartphone users but a much broader range of mobile subscribers"[4]. MCC can be described as a new paradigm for mobile applications whereby the data processing and storage are moved from the mobile device to powerful and centralized computing platforms located in clouds. These centralized applications are then accessed over the wireless connection based on a thin native client or web browser on the mobile devices. The mobile devices do not need a powerful configuration (e.g., CPU speed and memory capacity) since all the complicated computing modules can be processed in the clouds.

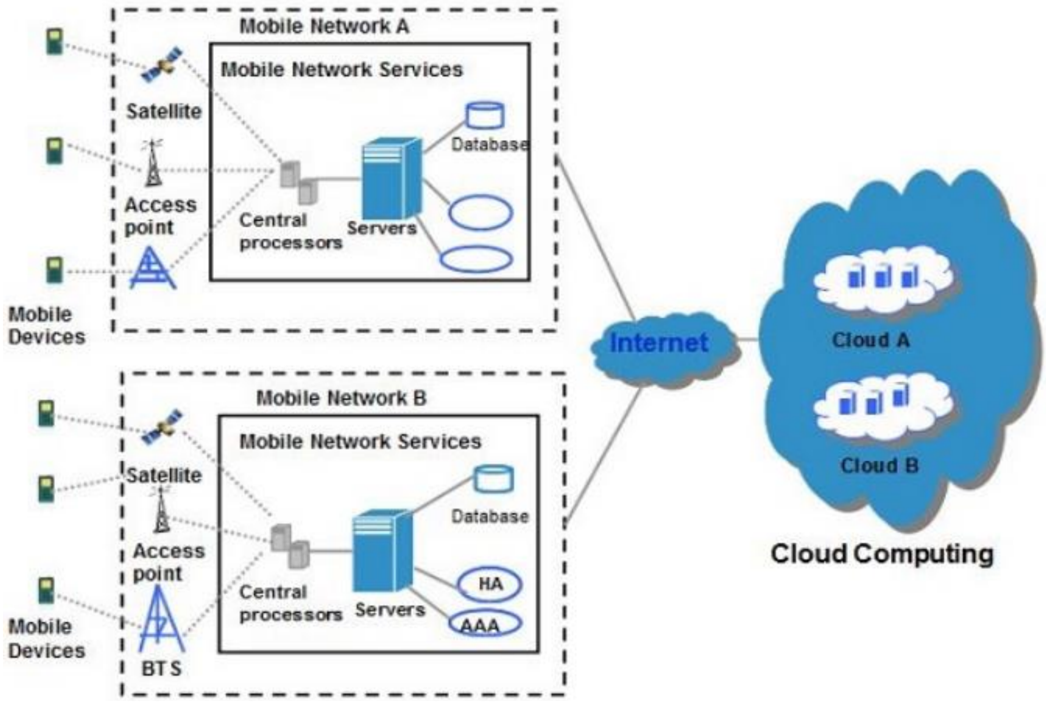

Fig. 1 Mobile Cloud Computing Architecture

B. Cloud Mobile Media

With the development of Web 2.0, Internet multimedia is emerging as a service. To provide rich media services, multimedia computing has emerged as a noteworthy technology to generate, edit, process, and search media contents, such as images, video, audio, graphics, and so on. For multimedia applications and services over the Internet and mobile wireless networks, there are strong demands for cloud computing because of the significant amount of computation required for serving millions of Internet or mobile users at the same time. In this new cloud-based multimedia-computing paradigm, users store and process their multimedia application data in the cloud in a distributed manner, eliminating full installation of the media application software on the users' computer or device and thus alleviating the burden of multimedia software maintenance and upgrade as well as sparing the computation of user devices and saving the battery of mobile phones.

CMM offers new opportunities for mobile network operators to close the growing gap between growth in data usage and data revenue by offering innovative CMM services and experiences, outside of conventional application stores where their participation has not been strong so far.

In the proposed model, we will focus on Cloud Mobile Media (CMM) applications and services, which will enable mobile users to not only access rich media from any mobile device and platform, but even more importantly, which will enable mobile users to engage in new, rich media experiences, through the use of mobile cloud computing, that are not possible otherwise from their mobile devices. The proposed model will use cloud for storage of video data and the user will be then able to access the data from any device (tablet, desktop or mobile) from anywhere. Thus cloud will help in efficient management of multimedia content for user without extensive requirement of resources on mobile device.

C. Cloud storage services

Mobile Cloud Storage is the most commonly used category of CMM application/service today, with offerings from Amazon, Apple, Dropbox, Funambol, and Google, among others. These services provide diverse capabilities, including storing documents, photos, music and video in the cloud, accessing media from any device anywhere irrespective of the source of the media and/or the device/platform used to generate the media, and synchronizing data/media across multiple devices a typical user owns. To enable mass adoption of such services, the PaaS providers will need to ensure high availability and integrity of data, and the SaaS provider will need to ensure content security and user privacy.

II. RELATED WORK

Despite increasing usage of mobile computing, exploiting its full potential is difficult due to its inherent problems such as resource scarcity, frequent disconnections, and mobility. Mobile cloud computing can address these problems by executing mobile applications on resource providers external to the mobile device[5].Continuous research is being carried out regarding cloud usage in mobile computing area. Dejan Kovachev et al [6] have proposed various application models are for implementing mobile cloud computing.

Kumar K and Lu YH [7] implied that offloading has gained big attention in mobile cloud computing research, because it has similar aims as the emerging cloud computing paradigm, i.e. to surmount mobile devices' shortcomings by augmenting their capabilities with external resources. Two sample applications illustrate the benefits of offloading: chess game and image retrieval. Chun and Maniatis [8] proposed architecture, CloneCloud that addresses these challenges via seamlessly offloading execution from the phone to computational infrastructure (cloud) where cloned replica of the smartphone's software is running. This architecture enables new, exciting modes of augmented execution for applications in diverse environments, and offers intriguing opportunities for research and for practical deployments that marry the convenience of hand-held devices with the power of cloud computing.

Similar approach of using virtual machine (VM) technologies executing the computation intensive software from mobile device is presented by Satyanarayanan et al. [9]. In this architecture, a mobile user exploits VMs to rapidly instantiate customized service software on a nearby cloudlet and uses the service over WLAN

Dejan Kovachev et al [10] have developed i5CLoud, a hybrid cloud architecture, which serves as a substrate for scalable and fast time-to-market mobile multimedia services .It demonstrates the applicability of emerging cloud computing concepts for mobile multimedia.

Shaoxuan Wang and Sujit Dey[2] have analyzed Mobile cloud computing approach with respect to challenges that need to be Addressed to make Cloud Mobile Multimedia applications viable, including response time, user experience, cloud computing cost, mobile network bandwidth, and scalability to large number of users, besides other important cloud computing issues like energy consumption, privacy, and security

Yu Wu et al [11] have developed a new mobile video streaming framework, dubbed AMES-Cloud, 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 her private agent adaptively adjust her 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.

III. PROPOSED WORK

Considering the increasing need of resources on mobile devices for multimedia applications as discussed in previous sections, we have proposed a model which used cloud resources for mobile multimedia application. One part of model consists of cloud server which is used for storage of multimedia content. In this model we are considering video data only as multimedia content. Second part of model consists of android client which will be installed of android device. User has to sign up into android application using username and password after user and device authentication user can view list of available videos if user clicks on one of the videos in list he will be redirected to next screen consisting of media player where user will be able to play selected video. In this model streaming technique is used for playing the video in media player. "Streaming" describes the act of playing media on one device when the media is saved on another. As this technique does not require actual video to be stored on mobile device for playing, in the proposed model it is not required that the video being played should be stored on mobile device.

The proposed model was then tested. In this model WAMP server is used for handling user and device authentication requests as well as for handling video requests. Actual videos are stored on this server.

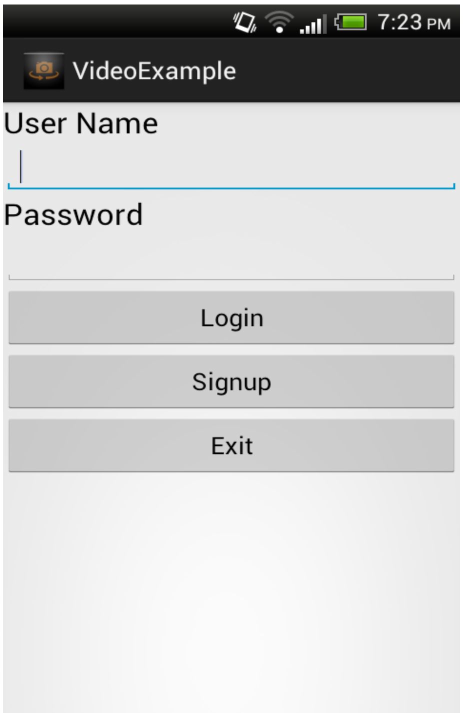

Fig. 2 Screenshot of login screen in application

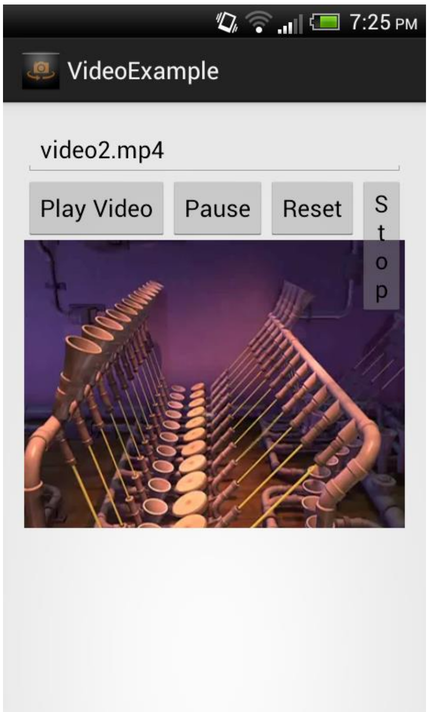

Fig. 3 Screenshot of video being played in application

IV. Application Evaluation

We tested the above application on HTC One V Android device. Connection between cloud server and android device was made using Wi-Fi network with 512 kbps speed. Then we found out response time of this application for videos of various sizes. Secondly we tested one web application which does the same task of playing video in browser (using HTML5) with same videos used in testing cloud application. Following graph shows the response time required in each type application for various video sizes.

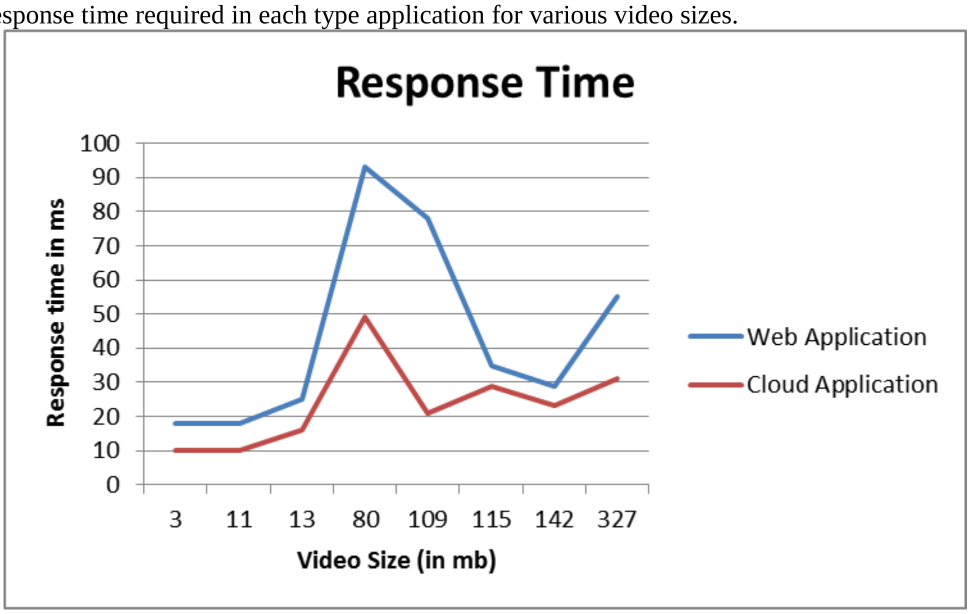

Fig. 4 Graph showing response time requirements of web application and cloud application

After observing graph we can conclude that response time of cloud application is less than response time requirements of mobile application using cloud resources.

Secondly we compared the application on the basis of memory requirement on device for executing the application.This comparison was done among three different types of applications 1)The web application which plays video in mobile browser 2)The mobile application installed on device which uses streaming technique for playing videos on mobile and uses cloud for storage of videos and 3)a native media player available on mobile device (in this case videos are stored on sd card of mobile) following graph shows the results on two different android devices.(HTC One V and Samsung Galaxy Tab II)

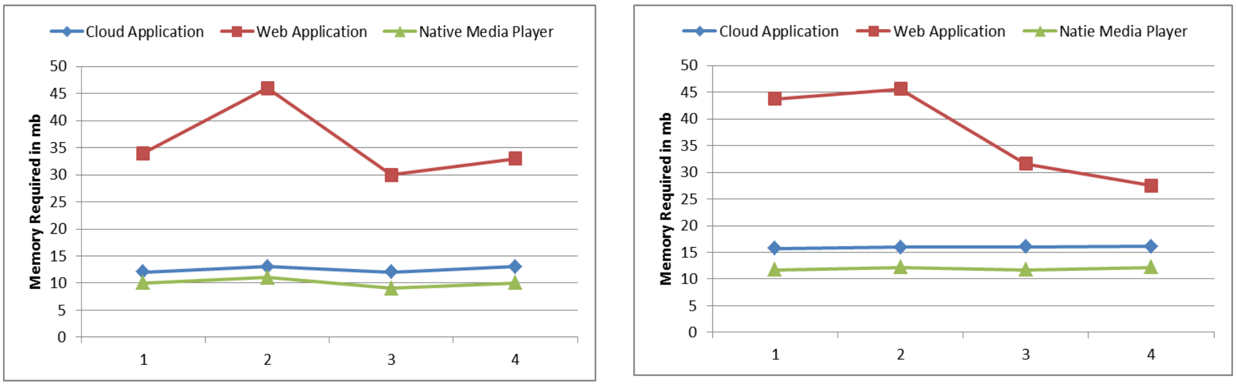

Fig. 5 Graphs showing internal memory requirements of web application, cloud application and native media player while executing on HTC One V and Samsung Galaxy Tab respectively

After observing above graph we can conclude that internal memory (RAM) required for executing cloud application is less than meory required for executing web application.Also from the graph we can see that internal memory required for playing video using native media player is lesser than other two cases.But the native media player requires that video to be played should be already stored in mobile device .Thus total memory required by native media player is video size plus RAM required while actually playing the video.Which is obiviously much more than memory required by cloud application.

V. CONCLUSION

Thus we can conclude that Mobile multimedia applications have high resource requirements on mobile devices, whereas only some of the devices are able to fulfill those requirements. Mobile cloud computing can help reduce this gap between requirements and availability of resources. Model proposed in this paper uses this technique. After analyzing the application result we can say that mobile application using cloud resources is more efficient in terms of response time as well as memory requirements.

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