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Survey of Mobile Cloud Media: A Cloud Centric Media Platform for End-to-End workflow and Layered Service Model

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Abstract: ***Nowadays, Smartphone's and wireless technology are rapidly increasing with the increase of population. The goal of wireless technology is to give user a comfort that, as soon as user thinks about any information it will come in front of user immediately. This paper surveys the most emerging paradigm of mobile cloud media. Cloud mobile media has basically two forms of views: An End-to-End view & a Layered view. Layered view as Infrastructure-as-a-service(IAAS), Platform-as-a-service(PAAS), Software-as-a-service(SAAS).***

Keywords: Cloud Computing, mobile media, Cloud media, Cloud centric media network.

1. Introduction

Rapidly increase of use of Mobile Phones, smart phones, tablets with the usage of wireless internet gives rise to huge demands for media applications. This result, in turn, is triggering an exponential growth of mobile traffic, dominated by video contents. 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[11].

According to electronic marketers, the total user of smart phones will become 1.75 billion in 2014 over the world. A user experience with mobile videos is basically contained by three fundamental challenges. First is the, limited on-board resource of mobile devices for media coding and processing [1]. Second, the time-varying and unreliable wireless channel limits the communication bandwidth between mobile devices & back-end content delivery systems [2]. Third, the relatively static mechanism of system resource provision in existing back-end systems cannot react fast enough to flash-crowd demands for popular contents [3].

The emerging cloud-computing technology [4] offers a good solution to decrease the cost of deploying and operating mobile media networks. Under the cloud-computing paradigm, system resources can be allocated dynamically to meet the elastic application demand in a real-time manner. For example, computing resources in data centers can be instantiated into virtual machines (VMs), whose capacity can be dynamically configured for specific media applications. Like this, the cloud computing paradigm has started to transform mobile media experience, resulting in a new area of research, cloud mobile media [5], [6], [7], [8].

Cloud computing faces some technical challenges they are:

- *Scalability*: The system should handle a large number of contents, users and devices.
- *Heterogeneity*: The system should be able to accommodate contents in different formats, users with different preferences, and devices with different forms.
- *Reliability:* The system should design with high calculated redundancy to offer non-interruptive services in presence of system failures, as well as issues of unreliable wireless channels.
- *Usability:* The system should design in such a way that, it is convenient for all users with a wide range of technology capabilities. The user interface should be easy to learn, intuitive, and suitable to various mobile devices with limited interactive options.
- *Security:* Digital Rights Management and privacy are the main concern should be takes place in cloud computing.

1.1. Cloud Mobile Media (CMM)

To provide rich media services, multimedia computing has emerged in various technologies 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 releaving the burden of multimedia software maintenance and upgrade as well as sparing the computation of user devices and saving the battery power of mobile[11].

1.2. Cloud storage Service

Mobile Cloud Storage is the most commonly used category of Cloud Mobile Media application/service today, with offerings from Amazon, Apple, Dropbox, and Google, among others. These services provide different capabilities,

including storing documents, photos, music and video in the cloud, accessing media from anywhere any device 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.

2. Cloud Mobile Media Network: A System View

In this paper, we present cloud mobile media system into a set of participatory modules as two alternative view points for the cloud mobile media architecture, including an end-to-end model and layered model.

2.1 An End-to-End workflow Model

In below fig.1, we present a systematic end-to-end view of the cloud mobile media system. The system consist of three main digital media contents they are, content providers, media cloud service providers, and content consumer [9].

- *Content Providers:* They are responsible for creating media contents for distribution and consumption. Media contents can be generated by professional producers with digital cameras, or internet users who capture videos or images with their own mobile devices. But here we are interested in capturing the media contents generated by mobile devices.
- *Media cloud service provider:* It collects together all the media related data and store into the cloud. Computation sizes are often comes with super-size storage capacity which is distributed across various locations and can be request on demand. The storage space could come from dense provisioning or sparse provisioning. These computing & storage resources are interconnected by a network fabric to formulate a pool of system resources which is shown in below fig.1.
- *Content Consumer:* They watch videos on different media devices such as, TV, laptops, smart phone, tablet, etc. via wireless internet. The design for this use case faces a list of technical challenges, including:
  - o Mobile devices are inherently resource constrained.
  - o The connectivity exposed to mobile devices is usually inferior to their desktop counterparts.
  - o The expectations of mobile users are increasingly higher, because features like mobility support, interactive support, come by naturally in non-media related applications.

  There are many solutions available on web for above challenges.
- *Mobile cloud edge:* This plays an important role in connecting resource-constrained mobile devices with resource-rich cloud infrastructure.

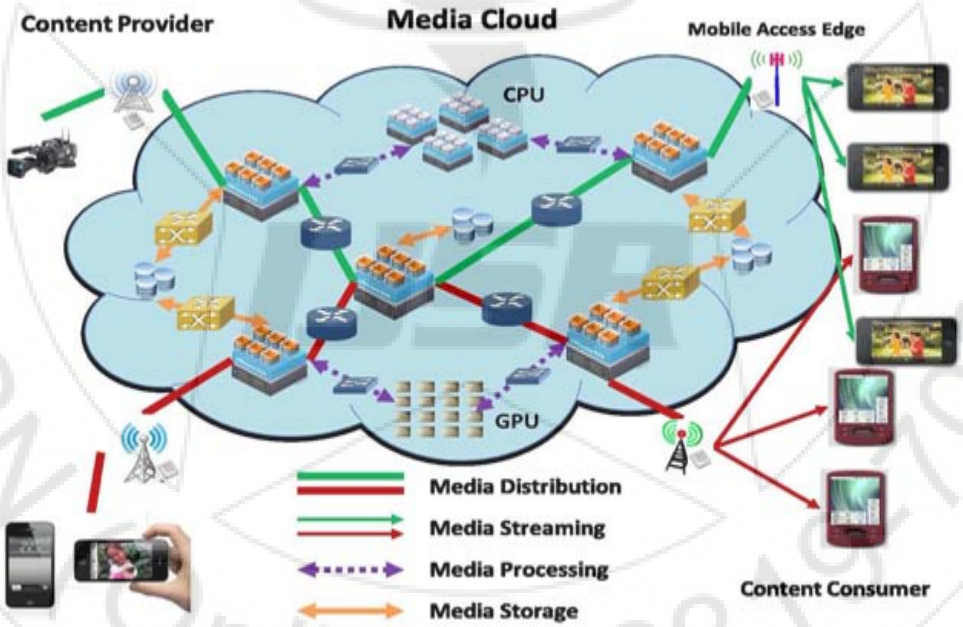

Fig. 1. An end-to-end view of a cloud mobile media network: content providers, media cloud service providers, mobile access cloud edge (possibly integrated with service providers) and content viewers are interconnected via an underlying network infrastructure supported by ICT resources.

2.2. A Layered Service Model

The cloud mobile media system, derived from the definition of Cloud Computing, and it can also be understood in a layered service model as shown in below fig.2.
In this layered model, there is no binding between two interfacing layers, but in internet layered model, service binding is enforced between interfacing layers. The layered view provides a conceptual hierarchy in to the cloud mobile media, they are as follows:

1) *Infrastructure-as-a-service:* In this IaaS layer, Information Communication Technology resources are pooled together from a hybrid cloud infrastructure. Enabled by virtualization technology[10], cloud service provider can aalocate these resources in a fine granular manner, to meet user specific demand.

2) *Platform-as-a-service:* In this PaaS layer, different media services are wraaped into a layer of middleware, running over raw Information Communication Technology

resources or cloud Information Communication resources. The cloud mobile media has been classified as media-specific services which are in four different categories are as follows:

- *Media Representation:* In this, encoding, decoding, and transcoding media contents in various container formats takes place.
- *Media Distribution:* It deals with acquiring media contents into the cloud, moving them across different processing units and streaming them to mobile devices.
- *Media Adaption:* This service refers to algorithms and mechanisms that modify the original media content in different domains or fields.
- *Media Analytics:* It refers to algorithms & mechanisms which are derived from media contents and in data analytics nature. The most famous service is the content search service & its associated data mining algorithms.

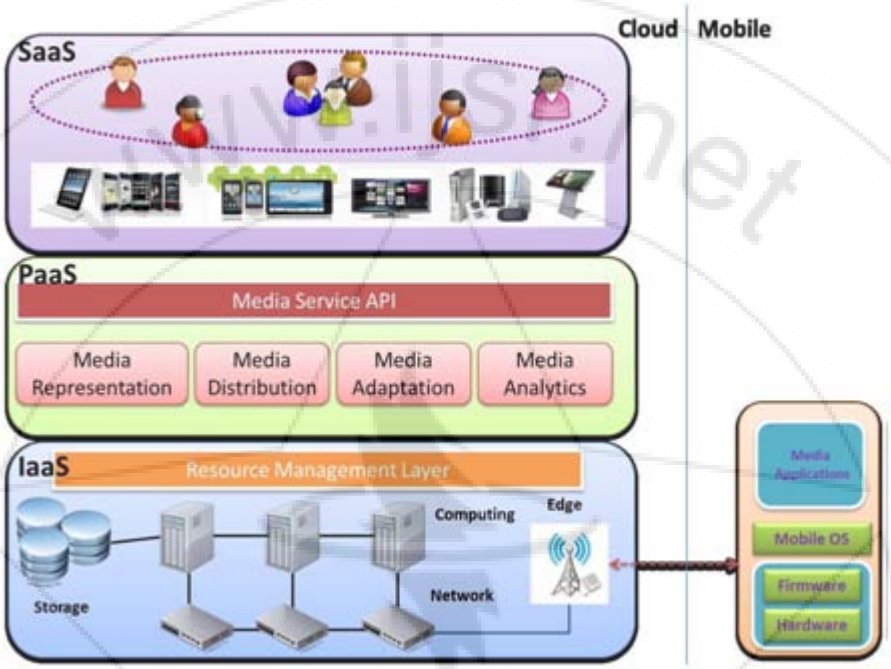

Figure 2: A layered view of cloud mobile media system, consisting of three service models (IaaS, PaaS and SaaS). Note that the three layers have no binding as in the traditional network layering architecture. In this view, the three layers merely follow from the three service models in cloud computing.

3)Software-as-a-service: In this layer, mobile media applications & contents are consumed by viewers in their mobile devices. Basically, these applications consist of a light-weight client running in the cloud. The design principle of cloud-based mobile media experience is to optimally leverage the strengths of both the mobile client and the cloud infrastructure/ service, with an objective to provide the best possible user experience at the lowest possible cost [9].

3. Applications of Cloud Mobile Media

3.1 Storage and Sharing

Cloud storage has one good advantage that user can access their files from anywhere with any wireless network device. And can able to share their files with anyone who may access the content at any time. Cloud storage can also provides a much higher level of reliability than local storage.

3.2 Authoring & Mashup

Authoring in multimedia is a process of editing segments of multimedia contents, while Mashup deals with combining multimedia contents from multimedia sources. Authoring and mixing consumes more time in performing its operation and multimedia requires more storage space to store the media related data. So, cloud computing solves this problem by making online authoring and mixing more effective, also providing more functions to clients, as it has more powerful computation and storage resources that are widely distributed to all over.

3.3 Adaption & delivery

Video Adaptation have very important role in multimedia delivery. It changes input videos into output videos according to user needs. Video adaptation requires large amount of computation power and it is difficult to do where there are many consumers requesting simultaneously. Cloud computing has strong computing power and strong storage power, and because of this both online & offline media adaptation to different types of terminals can be conducted in a cloud.

3.4 Media Rendering

As cloud computing consist of GPU, which can perform interpretation because of its strong computing capacity. Generally there are two types of rendering. One is to conduct all interpretation in cloud & second one is to conduct only computational intensive part of the rendering in the cloud,

while the rest will be done on cloud.

4. Conclusion

This survey concludes the study of cloud computing for mobile media with two view models that is, End-to-end model and Layered model. Also the application gives the overview of cloud computing advantage of use. On the cloud aware multimedia, we addressed how cloud-computing resources can be utilized by multimedia services and applications such as storage and sharing, authoring and Mashup, adaptation and delivery, and rendering and retrieval.

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