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Cloud Mobile Social T.V for Adaptive Video Streaming

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ABSTRACT

Smartphone provides most of the application that a pc system gives. Easy maintenance is the main attraction of android smart phones. In this paper, Articulate Features for Mobile-Social TV System using Cloud Computing (CloudMoV) is proposed. In common the problem while using the smart phones is the large power consumption. This application runs all the complex modules in cloud. The system effectively utilizes IaaS (Infrastructure-as-a-Service) cloud services to offer the living-room experience. Open Nebula sunstone using as the open source tool for implementing the cloud technology. IaaS cloud performs efficient stream transcoding that matches the current connectivity quality of the mobile user. DASH servers are used for the adaptive streaming and cooperative communication. Various designs for flexible transcoding capabilities- battery efficiency of mobile devices and spontaneous social interactivity together provide an ideal platform for mobile social TV services..

Keywords: Adaptive video streaming, Cloud, Synchronization.

1. INTRODUCTION

The recent cloud computing technology has rich resources to compensate for the limitations of mobile devices and connections. That can potentially provide an ideal platform to support the desired mobile services. The System proposed in this paper effectively utilizes both PaaS (Platform-as-a-Service) and IaaS (Infrastructure-as-a-Service) cloud services to offer the living-room experience of video watching to a group of disparate mobile users who can interact socially while sharing the video. A surrogate, performs efficient stream transcoding that matches the current connectivity quality of the mobile user is introduced.

Rapidly increasing power of personal mobile devices is providing much richer contents and social interactions to users. This trend however is brought up by the limited battery lifetime of mobile devices and unstable wireless connectivity, making the highest possible quality of service experienced by mobile users not feasible. Tough challenges arise on how to effectively exploit cloud resources to facilitate mobile services, especially those with stringent interaction delay requirements. In this paper, we propose the design of android web social TV using cloud technologies

A number of mobile TV systems have evolved in recent years, driven by both hardware and software advances in mobile devices. Some early systems bring the living room experience to small screens on the move. But they focus more on barrier clearance in order to realize the convergence of the television network and the mobile network, than exploring the demand of “social” interactions among mobile users. We propose the design of a Cloud-based, social TV system. The system effectively utilizes IaaS (Infrastructure-as a- Service) cloud services to offer the living-room experience of video watching to a group of disparate mobile users who can interact socially while sharing the video. To guarantee good streaming quality as experienced by the mobile users with time varying wireless connectivity, we employ a surrogate [2] for each user in the IaaS cloud for video downloading and social exchanges on behalf of the user. We design CloudMoV to seamlessly utilize agile resource support and rich functionalities offered by both an IaaS (Infrastructure-as-a-Service) cloud and a PaaS (Platform-as a-Service) cloud. In this paper, we describe the design of a novel mobile social TV system, CloudMoV, which can effectively utilize the cloud computing paradigm to offer a living-room experience of video watching to disparate mobile users with spontaneous social interactions. In CloudMoV, mobile users can import alive or on-demand video to watch from any video streaming site, invite their friends to watch the video concurrently, and chat with their friends while enjoying the video. It therefore blends viewing experience and social awareness among friends on the go.

1.1. General Concepts

Video on-demand and live streaming

There are two different ways to use streaming techniques. In the first one, video on-demand, users request media files which have been previously recorded and compressed and are stored on a server. Today this technique has become very popular, with YouTube being the most popular website offering on-demand streaming. The alternative is live streaming which enables an unbounded transmission where media is generated, compressed, and delivered on the fly. In the case of live streaming there may or not may be a concurrent recording (which could be transmitted later on-demand).

Both streaming techniques may offer the user basic video control functions such as pause, stop, and rewind. Additionally, for on-demand streaming there may be the possibility of issuing a fast-forward command. Note that fast forward is only possible when the media files are stored, thus the future content is known. Of course it is also possible for the system to implement the possibility of a fast-forward command if the user has pause the playback, but this will be limited to moving forward to the recently generated portion of the content.

Google's Android operating system

Android is an operating system specially designed for mobile devices. It is mainly developed and supported by Google Inc., although other members of the Open Handset Alliance (OHA) have collaborated in its development and release.[4] Figure 1 reviews Android's version history.

Version	Codename	Release date	Linux kernel version
1.0	None	23 September 2008	Unknown
1.1	None	9 February 2009	Unknown
1.5	Cupcake	30 April 2009	2.6.27
1.6	Donut	15 September 2009	2.6.29
2.0/2.1	Eclair	26 October 2009	2.6.29
2.2	Froyo	20 May 2010	2.6.32
2.3	Gingerbread	6 December 2010	2.6.35
2.4	Ice Cream Sandwich	Not released	Unknown
3.0	Honeycomb	22 February 2011	2.6.36
3.2	Honeycomb	15 July 2011	2.6.36

Figure 1: Android Version History

Android is based on a modified version of the Linux kernel and its applications are normally developed in the Java programming language7. However, Android has not adopted the official Java Virtual Machine (JVM), meaning that Java Byte code cannot be directly executed. Instead, applications run on the Dalvik Virtual Machine (DVM), a JVM-based virtual machine specifically designed for Android. DVM is optimized for mobile devices, which generally have CPU performance and memory limitations. In addition, DVM makes more efficient use of battery power. Applications are usually released via the Android Market, Google's official online store. Nevertheless, publication of the applications is not restricted, allowing installation from any other source.

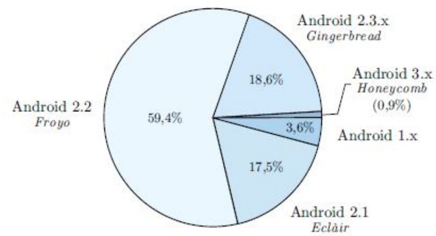

Figure 2: Distributions of Android platform versions

Figure 3.2 shows the current distribution of Android versions based on the operating system of the devices that have recently accessed the Android Market. As shown, Android's newer versions (the 3.x branch) are only slowly being adopted, for example Honeycomb still represents less than 1% of the overall of Android devices, while Froyo the predominate version (running on almost 60% of the devices that access the Android Market).

Adaptive streaming

Adaptive streaming [6] is a technique which detects the user's available bandwidth and CPU capacity in order to adjust the quality of the video that is provided to the user, so as to offer the best quality that can be given to this user in their current circumstance. It requires an encoder to provide video at multiple bit rates (or that multiple encoders be used) and can be deployed within a CDN to provide improved scalability. As a result, users experience streaming media delivery with the highest possible quality.

Synchronization between server and client

In the particular case of live video content, it is useful if both server and client have the same sense of time. Synchronization in this context means that provider and consumer sides communicate with an external time server to set their clocks to the same accurate time base. Compared to a non-synchronized scheme, clients does not need to make so many queries to the server (HTTP requests) since the clients know in advance when new content will be available.

Synchronization is achieved by means of the Simple Network Time Protocol (SNTP) [3], which is based on the Network Time Protocol (NTP). Fortunately, many NTP public servers are freely available on the Internet. The NTP Pool project5 has been selected for this purpose because it provides a pool of free NTP servers operating on a reasonable-use basis. Indeed, the implementation of this prototype follows the recommendations of [5] to perform a fair use of the time servers, thus periodic requests are never performed more frequently than every 30 seconds.

2. CLOUDMOV: ARCHITECTURE

As a novel Mobile-Social TV system using cloud computing (CloudMoV), provides two major functionalities to participating mobile users: (1) Universal streaming: A user can stream a live or on-demand video from any video sources he chooses, such as a TV program provider or an Internet video streaming site, with tailored encoding formats and rates for the device each time. (2) Co-viewing with social exchanges: A user can invite multiple friends to watch the same video, and exchange text messages while watching. The group of friends watching the same video is referred to as a session. The mobile user who initiates a session is the host of the session. The architecture of CloudMoV and the detailed designs of the different modules is presented in the following.

Figure 3 gives an overview of the architecture of CloudMoV. A surrogate (i.e., a virtual machine (VM) instance), or a VM surrogate equivalently, is created for each online mobile user in an IaaS cloud infrastructure. The surrogate acts as a proxy between the mobile device and the video sources, providing transcoding services as well as segmenting the streaming traffic for burst transmission to the user. Besides, they are also responsible for handling frequently exchanged social messages among their corresponding users in a timely and efficient manner, shielding mobile devices from unnecessary traffic and enabling battery efficient, spontaneous social interactions.

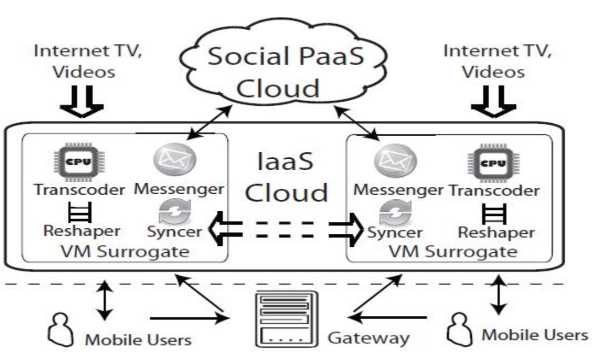

Figure 4: Architecture of Cloud MOV

The surrogates exchange social messages via a back-end PaaS cloud, which adds scalability and robustness to the system. There is a gateway server in CloudMoV that keeps track of participating users and their VM surrogates, which can be implemented by a standalone server or VMs in the IaaS cloud. The design of CloudMoV can be divided into the following major functional modules.

1. Transcoder

Each surrogate has transcoder. It is dynamically deciding how to encode the video stream from the video source in the appropriate format, dimension, and bit rate. The video stream is further encapsulated into a proper transport stream before delivering to user. Each video is exported as MPEG-2 transport streams, which is the de facto standard use to deliver digital video and audio streams over lossy medium.

2. Reshaper

The reshaper placed in each surrogate. That receives the encoded transport stream from the transcoder and chops it into segments, and then sends each segment in a burst to the mobile device upon its request to achieve the best power efficiency of the device. The amount of data in each burst is carefully decided according to the 3G technologies implemented by the corresponding carrier.

3. Social Cloud

It is built on top of any general PaaS cloud services with BigTable-like data store. Our prototype can be readily ported to other platforms. It stores all the social data in the system, including the online statuses of all users, records of the existing sessions, and messages in each session. The social data are categorized into different kinds and split into different entities [1]. The social cloud is queried from time to time by the VM surrogates.

4. Messenger

Messenger resides in each surrogate in IaaS cloud and it is the client side of the social cloud. Social cloud is been queried by the messenger for the social data on behalf of the mobile user and at much lower frequency pre-processes the data into a light-weighted format (plain text files).Only little traffic is incurred when the plain text files (in XML formats) are asynchronously delivered from the surrogate to the user in a traffic-friendly manner. In the opposite direction, the messenger transmits this user’s messages (invitations and chat messages) to other users via the data store of the social cloud.

5. Syncer

Each surrogate consist syncer. The syncer guarantees that viewing progress of this user is within a time window of other users in the same session (if the user chooses to synchronize with others).The syncer periodically retrieves the current playback progress of the session host and instructs its mobile user to adjust its playback position. Syncers on different VM surrogates communicate directly with each other

6. Mobile Client

The Mobile client supports the HTTP Live streaming protocol so it is not required to install any specific client software in order to use CloudMoV, and it has an HTML5 compatible browser (e.g., Mobile Safari, Chrome, etc.). Both are widely supported on most state-of-the-art smartphones.

7. Gateway

Authentication services for users to log in are provided by the gateway to the CloudMoV system. It stores users' credentials in a permanent table of a MySQL database it has installed. A VM surrogate will be assigned the user after he successfully logs in to the system.

3. CONCLUSION

In this paper we introduced an android application that giving a living room experience while watching a video. The rapidly increasing power of personal mobile devices (Smartphone, tablets, etc.) is providing much richer contents and social interactions to users on the move. This trend however is throttled by the limited battery lifetime of mobile devices and unstable wireless connectivity, making the highest possible quality of service experienced by mobile users not feasible. The recent cloud computing technology, with its rich resources to compensate for the limitations of mobile devices and connections, can potentially provide an ideal platform to support the desired mobile services. We are using the IaaS cloud services, the open source tool that used is open nebula and the upcoming open nebula sunstone technology is used for the implementation.

The cloud helps to utilize the power properly. We divided the entire project into six modules and in the cloud there exist 4 virtual instances. The android mobile user that is the client is connected to the cloud and the user can watch the video with his friends who are online at the same time. The videos are uploaded in the multimedia repository and the proper sharing is achieved by the DASH. MySQL is used for storing the user information. While watching the video the user can also chat with the friends. As like any social network this application is also support the friends inviting and chats. Future work is to add additional features to this application such as online video chatting.

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