Customizable Real-time Flash Video Delivery to iPhones

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ABSTRACT
This paper presents a brief report of a system called Vmoox that delivers customized video content to mobile devices, in particular to Apple iPhones. With a design based on the SaaS (software as a service) model, Vmoox not only transcodes Adobe Flash content to Apple iPhones in real-time, but also allows publishers to inject additional content into video streams.

1 INTRODUCTION
Adobe Flash is the standard format for delivering online video content to traditional computers, because of its high-quality/low bit rate (small file size) capabilities. Nearly 99% of online users are able to view Flash files [1]. Due in part to Flash's significant power consumption, delivery of Flash encoded videos to mobile devices, such as smart phones, remains problematic [2]. Adobe itself has addressed this challenge by partnering with processor manufacturers such as Texas Instruments and ARM to furnish versions of Adobe Flash Player optimized for smartphones and internet devices manufactured by companies such as Nokia and Samsung that are based on these chips [3].

Apple's iPhone is another matter. The iPhone owns nearly 50% of the United States smartphone traffic [5]. But it remains unclear when such a Flash player will become a reality [6]. In the short term, one alternative solution to delivering Flash video is to transcode it into a format that the iPhone understands.

A video format that the iPhone does understand is the H.264/AVC open standard codec developed by the ITU-T Video Coding Experts Group [7]. A number of commercial hardware and software solutions are available for transcoding Flash into H.264/ AVC that either work offline [8] [9] or in real-time [10]. But these systems consider only a part of a video content publisher's workflow. Development of complete integrated systems remains open for exploration.

In an attempt to address this issue we have built a customizable and scalable video encoding and publishing system for web publishers called Vmoox (wordplay on *V*ideo *mu*ltiple*x*er).

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Vmoox is designed to be a publisher's solution based on a SaaS (Software as a Service) model [11], in which an application is licensed to customers for use as a service on demand. The main advantages of adopting a SaaS model are: centralized feature updating with immediate access to upgrades without the need to download and configure new software, low financial risk in a pay-as-you-go paradigm, and fast implementation that eliminates the need to install, deploy and configure any software.

2 SYSTEM DESIGN
The two core services which Vmoox provides are a publisher service interface and a video transcoding service. The publisher service interface is an API that enables publishers to initialize accounts, retrieve data from their websites, distribute video content on mobile devices, and perform updates as needed. The video transcoding service performs offline and real-time encoding transformations of Flash to H.264/AVC videos. It is designed to support the publisher service interface as part of an offline initialization setup and update, as well as real-time on demand encoding requests.

Vmoox's publisher service interface and video encoding service are implemented employing two technologies. The latter component relies on FFmpeg and libavcodec to transcode Flash video files to H.264/AVC, create thumbnails for the video stream, and generate chapters from the original video files. FFmpeg is a cross-platform API that records, converts, and streams audio and video. It incorporates the libavcodec open source audio/video codec library that includes video decoders and encoders for a variety of video formats including flash video and H.264/AVC formats [12].

The publisher service interface uses JSON/JSONP, a lightweight protocol that enables developers to easily connect to Vmoox's web service and to use Vmoox's data in their own applications. JSON (JavaScript Object Notation) is a data format that is a subset of JavaScript and can be easily parsed by a browser. In addition, Objective-C, the iPhone's programming language, provides easy integration with a JSON enabled web service.

Vmoox is designed as a loosely coupled collection of modules. Different modules in the system interact with each other through an API regardless of how each component is implemented. This improves software maintainability and readability as well as opening Vmoox to third parties who may use Vmoox in combination with their own software applications.

3 SAMPLE SESSION

Using CNN as a sample publisher and a native iPhone application as the sample client implementation, the sequence of steps that constitute the Vmoox service workflow are as follows:

CNN provides Vmoox with an XML file containing its videos and their meta-data as well as pre-roll content along with pairing criteria (i.e., which ads should be paired with which content). Vmoox's publisher service interface imports CNN's original Flash files onto its server and logs the meta-data in the Vmoox database. The video encoding service divides each video into three minute chapters, transcodes the first chapter, and creates a thumbnail for each video. At this point a native iPhone application is delivered to the client as per client design criteria. A user downloads the application and selects a video from the Featured View list (Figure 1a). This is the first view a user sees upon launching the application and includes the latest (or preferred) video content from the publisher. When the user selects a video by clicking on the video image or the blue arrow directly to its right the iPhone app sends an HTTP GET request to the Vmoox server which responds in turn with a JSON/JSONP list of chapters (Figure 1b). Meanwhile, the video encoding service decides which chapters need transcoding and begins transcoding the ones that do. Video content is then paired with pre-roll content as per client specifications. Clicking on the video thumbnail in the Video View (Figure 1b) initiates the video - playing the pre-roll content (Figure 2a) and video (Figure 2b).

Figure 1. Two views of the iPhone application: a) Featured View, b) Video View.

Figure 2. A video being played with a) pre-roll ad, b) video content from CNN.com

4 DISCUSSION

While the CNN native iPhone application works well as a prototype, some changes to the design of the Vmoox system will need to be made as individual publishers purchase the service. Each client has a unique set of requirements and both the application and service will be adapted in each case. In the future, Vmoox's efficiency may be improved further by including a "stop transcode" feature that would identify when a user has stopped viewing a clip so the system may be instructed to cease transcoding any remaining chapters. Such an enhancement would be significant because recent research has shown that the average duration of video consumption on mobile devices is 3.2 minutes [13]. Finally, data collected by publishers regarding their individual audiences may impact the way the Vmoox service interacts with a publisher's content (e.g. CNN viewers might have a lower or higher average view time, calling for an adjustment to chapter lengths). As such, we believe that customizability is essential to Vmoox's potential for success. Although several transcoding solutions currently exist in the market, we have not yet found one that offers a customizable "one-stop-shop" approach to content management, transcoding, and delivery.

5 REFERENCES

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