

# A Cloud-based Transcoding Framework for Real-time Mobile Video Conferencing System

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**Abstract**—High-definition video applications are often challenging for mobile devices due to their limited processing capability and bandwidth-constrained network connection. To deal with this issue, this paper proposes a cloud based transcoding framework to achieve scalable and efficient video adaption for mobile devices. This framework introduces a prediction-based scheduling algorithm to optimize both latency requirement and cloud utility cost for mobile clients. Following this framework, we developed a prototype system based on Windows Azure. Experiment results show that our system can effectively provide low-latency and cost-efficient video service to mobile clients.

**Keywords**—transcode, cloud, azure

## I. INTRODUCTION

In recent years, multimedia applications on mobile devices especially smart phones have been very popular. Thanks to the rapid development of wireless communication technologies, bandwidth of mobile connections including both 3G and 4G network become sufficient to sustain real-time video streaming. But high-definition video streaming still poses challenge for mobile devices due to their limited capability. Compared to the regular website and desktop client, mobile clients often have limited screen size, relatively slow network connection as well as restrained battery time. Such mismatch between the capability of mobile devices and video application can be further elaborated in two aspects:

1) Variability of the network environment: In contrast with the wired network for desktop-based Real-time Multimedia System, wireless networks for mobile clients tend to have more lossy and unstable connection where their bandwidth often changes in a more frequent and intense way. In order to guarantee smooth and high-quality video delivery for a mobile client, the system must dynamically adjust the bitrate of the video stream sent to the client to cope with the variability of mobile network environment.

2) Diversity in capability of mobile devices: Mobile devices are very diversified in terms of video processing. High end smart phones often have hardware accelerator for video decoding. For example, the built-in support for hardware-decoding H.264 video, has been available among several models of smart phones, whereas a majority of mobile phones are not able to support hardware decoding. In addition, mobile devices' screen

size and resolution are also varied, ranging from 800\*480 to 1280\*800 etc. For better video rendering performance, the system has to send videos in the suitable resolution to match the capability of the clients. In this case the system should send video streams in different encoding methods, based on hardware support situations for different kinds of clients.

Thus, it is essential to have a video transcoding proxy to perform video adaption for mobile devices to receive high-resolution and low-latency video streams. Traditionally, video transcoding is implemented on either peer-to-peer or distributed proxy architecture. But those approaches are not easy to scale up in practice. Because a peer-to-peer overlay consisting of dynamical on-and-off host machines cannot provide large amount of stable computing resources to run the computational intensive tasks demanded by video transcoding. With the high development of Cloud computing, especially mobile cloud [1][2], enables Cloud based transcoding service an effective solution to the problems arose in high quality mobile video streaming. It cannot only provision computing resources for transcoding workload in on-demand way but also introduce new features in optimizing transcoding processing, intelligently adapting video contents and reducing computation overhead on behalf of mobile devices.

The key design issue of a cloud-based real-time transcoding system is how to utilize cloud resources to provide the best quality-of-service to mobile clients with the minimization of video communication latency and utility cost incurred by transcoding. Our system uses Microsoft's Azure as the cloud platform, which provides reliable and comprehensive virtual platform so that developers can easily create/destroy the virtual machines, set message service bus, transfer information using the PAAS provided by Azure. This paper implements a real-time multimedia transcode system based on Windows Azure, which has the following features:

1) High elasticity: Taking the advantage of the Windows Azure platform, the system can quickly allocate computing and communication resources towards the dynamic needs of mobile clients. Whenever there are new requests issued by a mobile client, the system can quickly build a transcoding pipeline to match its capability with the requested video stream. Based on the workload predication model, the system can provision sufficient virtual machines for running this pipeline and network bandwidth for video transmission.