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ACM Transactions on Multimedia Computing, Communications, and Applications (TOMM)

Special Issue on Delay-Sensitive Video Computing in the Cloud

Video applications are now among the most widely used and a daily fact of life for the great majority of Internet users. While *presentational video* services such as those provided by YouTube and NetFlix dominate video data, *conversational video* services such as video conferencing, multiplayer video gaming, telepresence, tele-learning, collaborative shared environments, and screencasting, as well as visual control systems such as tele-operation or remote-controlled drones, also have significant usage and tremendous potential. With the advent of both mobile networks and cloud computing, we are seeing a paradigm shift, where the computationally-intensive components of these conversational video services are moving to the cloud, and the end user's mobile device is used as an interface to access the services. By doing so, even mobile devices without high-end graphical and computational capabilities can access a high fidelity application with high-end graphics.

What distinguishes conversational video systems from other video systems is the fact that they are highly *delay sensitive*, and this sensitivity is a major challenge for operating them in the cloud. While buffering and interruptions of even a few seconds are tolerated in presentational video applications, conversational video applications require a much tighter end-to-end delay (input-to-display delay), usually in the range of 150 to 250 milliseconds, beyond which the application will "fail" since it is not responding to user interactions fast enough. The great majority of recent proposals for cloud-based encoding of video mostly use the well-known Hadoop and Map/Reduce technologies. However, the processing time of these techniques cannot meet the tight delay thresholds of conversational video scenarios, where the video must be processed "live" as it is coming. Delay-sensitive processing and rendering of video in the cloud has therefore become an emerging area of interest.

Running conversational video applications in the cloud introduces several challenges: First, video requires high bandwidth, especially if the scene must be sent to multiple users. Second, conversational video is sensitive to network latencies that impair the interactive experience of the application. Third, the mobility of today's users poses another set of challenges. Due to the heterogeneity of end users' devices, the cloud has to adapt the video content to the characteristics and limitations of the client's underlying network or end device. These include limitations in the available network bandwidth, in the client device's processing power, memory, display size, battery life, or the user's download limits or roaming fees. While some of these restrictions are becoming less problematic due to rapid progress in mobile hardware technologies, battery life in particular and download limit to some extent are still problems that must be seriously considered. Furthermore, consuming more bandwidth or computational power, even if available, means consuming more battery.

For this special issue, we seek original research papers that report on new approaches, methods, systems, and solutions that overcome the above shortcomings. Potential topics of interest include, but are not limited to:

- Methods to speed up video coding and video streaming at the cloud side
- Methods to decrease video bandwidth requirements while maintaining visual quality
- Energy-efficient cloud computing for video coding and rendering at the server side
- Efficient capturing, processing, and streaming of user interactions to the cloud, such as traditional, Kinect-like, Wii-like, gesture, touch, and similar mobile and touch-based user interactions
- Virtualization of large volume user inputs (e.g., depth sensor video) in the cloud
- Remote desktop, screen sharing, and Game as a Service (GaaS)
- Video-based telepresence, collaborative shared environments, cloud gaming, and augmented reality
- Optimizing cloud infrastructure and server distribution to efficiently support globally distributed and interacting users
- Resource allocation and load balancing in the cloud for optimized application support
- Network routing, software defined networking (SDN), virtualization, on-demand dynamic control of the cloud infrastructure
- Network and end-system mechanisms to reduce latency in cloud-based interactive services
- Adaptive video streaming according to network/user's limitations
- Quality of Experience (QoE) studies and improvements for delay-sensitive video computing in the cloud: user-cloud and user-user interactions, effects of delay and visual quality limitations, and methods to improve them
- Novel architectures and designs based on cloud video rendering, such as cloudlet-assisted systems, for video conferencing, telepresence, tele-learning, collaborative shared environments, screencasting, video gaming, augmented reality, and other conversational video applications and systems

Important Dates

Initial Paper Submission: August 20, 2017
Decision Notification: October 20, 2017
Revision Due: December 20, 2017
Acceptance Notification: February 15, 2018
Camera-Ready Version Due: February 28, 2018
Online Publication: April/May 2018

Manuscript Submission and Reviewing Process

Submissions should contain original material that has not been previously published in a journal, nor is currently under review by another journal. If material in the submission was previously published in a conference paper, the new submission must (i) technically extend the published version by at least 25% new material, (ii) explicitly cite the prior conference paper, and (iii) explain in an accompanying cover letter what has been extended in the new submission. Manuscripts must be prepared according to the ACM TOMM journal guidelines (available at http://tomm.acm.org/authors.cfm), and submitted online using the ACM Manuscript Central System (available at https://mc.manuscriptcentral.com/tomm). Please make sure to select this special issue when reaching the manuscript "Type" step in the submission process.

Submitted papers will be evaluated based on their originality, presentation, contributions, and relevance to the theme of this special issue, and will be reviewed by at least three independent experts in the field.

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