

Advances in Multimedia Communications

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Recent advances in communications technologies have witnessed a growing and evolving multimedia content delivery market based on information gathering, manipulation, and dissemination. It is a fact that personal communications, computing, broadcasting, entertainment, etc. have turned into streams of multimedia content, and the various communication and network technologies have become the means to carry that content to a wide variety of terminals. Unlike traditional communication systems, a fundamental challenge for present and future communication systems is the ability to transport multimedia content over a variety of networks energy-efficiently at different channel conditions and bandwidth capacities with various requirements of quality-of-service. There are many issues need to be addressed such as signal processing, collaborations, power management, flexible delivery, specialization of new content, dynamic access, telecommunications, networking, etc., due to the multi-disciplinary nature of the applications in advanced multimedia communications.

The goal of this issue is to bring together the state of the art research contribution that describes original and unpublished work addressing the new emerging techniques on multimedia communications. Especially, we solicit research papers on addressing challenging issues existing for enabling mobile multimedia communications over heterogeneous infrastructure for realizing next generation networking and computing. For example, ubiquitous multimedia is a requirement in next generation networks, such as multimedia adaption in wireless network; multimedia services in ubiquitous circumstance; improving distributed multimedia communication through location awareness, action awareness, user awareness, etc. On the other hand, due to the limited computational power, memory and battery energy in wireless and portable terminals, power efficient design also plays important role in next generation mobile multimedia applications.

We have received a large number of papers from both academia and industries that covered a variety of interesting topics related to multimedia communications. Two rounds of careful review by the guest editors and experts in the field led to nine papers for inclusion in this issue.

The first paper “Tournament-Based Congestion Control Protocol for Multimedia Streaming in Ubiquitous Sensor Networks” by C. Lee et al, addresses the issue of congestion and latency which have impact on energy efficiency, memory size, buffer size, and throughput in the ubiquitous sensor network. The authors propose a new method, called TCCP (Tournament-based Congestion Control Protocol), where the winner is the stream with the highest importance level in the competition of ubiquitous sensor network. In general, there are a lot of congestion and delay in the continuous streaming of multimedia streams with lower importance level. The proposed method consists of three parts: tournament decision, best-fit control strategy and service differentiation. The final winner in the tournament controls congestion effectively, minimizes packet loss due to congestion, decreases energy consumption, and improves QoS. The simulation result shows that the proposed method is more effective and has better performance compared with those of CCF (congestion control and fairness), PCCP (priority based congestion control protocol), and CODA (congestion detection and avoidance).

In the paper “3D Video Communications Challenges and Opportunities”, G. Su et al. survey major techniques in 3D communications area, which covers the whole pipeline of the 3D video communication framework, including 3D content creation, data representation, compression, delivery, decompression, post-processing and 3D scene rendering stages. The authors also highlight a few features in the emerging 4G wireless systems that are critical for 3D communications system design. At the end, the topics with potential but challenges, for example, 3D over 4G networks, distributed 3D video coding, 3D multi-user communication, scalability and universal 3D access, are discussed and pointed out to audiences for further

investigation.

X. Liu et al., in the paper “Efficient Temporal Error Concealment Algorithm for H.264/AVC Inter Frame Decoding”, propose an efficient TEC (temporal error concealment) algorithm for H.264/AVC video coding standard. According to the variable motion compensation block sizes, the 4x4 sub-block is selected as the MV recovery unit in order to get more accurate MV recovery for the lost MB. The direction trend of the neighboring MVs is utilized as the basic idea and the MV interpolation is employed to recover the MVs of the lost MB. The simulation results show that the proposed ETEC (efficient temporal error concealment) algorithm can always achieve better TEC performance compared with the existing TEC methods. And it can be widely employed in the multimedia communication systems with the video coding standard H.264/AVC.

In the paper "A Stereoscopic Video Transmission Algorithm for an IPTV Network Based on Empirical Data" written by Jaime Lloret et al., the authors evaluate the QoS and QoE of a stereoscopic IPTV service and study the performance of the codecs in existence in order to propose an algorithm to perform the appropriate decisions in the IPTV network. The algorithm is based on the empirical gathered from the network in order to provide the best QoE to the end users. Finally, the authors show the measurements of the bandwidth, delay and jitter of the transmitted stereoscopic IPTV when the algorithm is running, and they compare the QoS parameters when different codecs are chosen by the algorithm. Their test bench demonstrates that their proposal performs very well when several network conditions are varied.

The paper "On the Design of Algorithms for Mobile Multimedia Systems: A Survey" by X. Ma, J. Liu and H. Jiang, suggests that the existing solutions to multimedia in wired networks can not directly apply to wireless networks with lower bandwidth, higher latency, and higher burst error rate. Furthermore, these services could suffer from user's mobility and the heterogeneity caused by different wireless technologies (e.g., CDMA2000, WCDMA, TD-SCDMA, Wi-Fi, LTE, and WiMAX). The paper then reviews the issues and state-of-the-art solutions of mobile multimedia, focusing on multirate multicast, scalable video coding (SVC) and QoS management. Besides, the opportunities as well as the challenges of providing multimedia services in the next generation wireless mobile systems – 3GPP Long Term Evolution (LTE) are investigated.

In the paper “A novel low-power RF4CE-based communication framework for multimedia system control”, B. Koo et al. propose a novel low-power RF4CE-based communication framework (RCF) for Multimedia System Control in order to overcome many constraints of IR-based legacy solutions and support energy-efficient multimedia communications. A remote control (RC) is a component that operates electronic devices wirelessly issuing commands to consumer electronics (CE). Such existing RC solutions are based mainly on the infrared radiation (IR) technology with a line-of-sight barrier and they lack various additional features such as bi-directional and richer communications, low-power consumption, and no line-of-sight barriers which are needed for the flexibility and interoperability of more intelligent new CE devices on the market. The proposed RCF framework is designed for multimedia control communication using smart phones, adopting the RF4CE protocol which is a de facto radio frequency standard for CE remote control solutions. The analysis of energy consumption and two verification scenarios, including the use of various CEs and smart phones, show that our proposed RCF framework provides good practical usage in terms of content-sharing and smart CE control.

Deployment of P2P systems in IMS networks entails a number of technical challenges, because the decentralized model of peers' communication comes in contradiction to that of the client-server that is currently widely used for telecommunication services realization. Moreover, the charging schemes applied today in telecommunication networks are based on physical link utilization business models that are not applicable on P2P systems, whereas, conventional network resources sharing in the context of telecommunication services, is realized with dedicated QoS reservation mechanisms, not applicable on P2P systems that are highly autonomous and self-organized. Additionally, P2P systems have been very less deployed, if not at all, in the implementation of real-time communications. Main reason of this asymmetric development can be attributed to the inability of P2P systems to cope with the timing requirements that real-time communications imply for the network services and the limited perception of content quality and its implications for the quality of the communication link. With regard to this problem, in the paper “Enabling live video streaming services realization in telecommunication networks using P2P technology”, N. Efthymiopoulos et al., present a P2P system which is able to cope with the Quality of Service (QoS) settings of the network and therefore is suitable for accommodating real time video streaming applications.

Y. Huang et al. in the study called “A personalized mobile IPTV system with seamless video reconstruction algorithm in cloud networks” present a personalized mobile IPTV system based on a cloud network. The system allows users to browse their favorite multimedia videos in the cloud networks through mobile devices without the trouble of repeated and complex searches of multimedia files. It can automatically search for nearby multimedia data that users are browsing, and reconstruct

dispersed video contents through a seamless video reconstruction algorithm (SVRA) for integration into video data for continuous play. SVRA splits each original image into different parts, obtains the feature values of the images, and then compares multimedia files with approximate video section characteristics. The study focuses on the design and implementation of a seamless video reconstruction algorithm on video streaming service, and validation of the accuracy of the theories and the algorithm through the proposed system are presented in this paper. This system was tested and validated with success.

In the last paper “Identifying QoS Violations through Statistical End-to-End Analysis”, Lifeng Zhou et al. investigate multimedia transmission over the network is susceptible to various runtime impairments such as process failure, network congestion or link error. Existing work usually determines such QoS violations through condition-action rules, which trigger corresponding actions once pre-described conditions are satisfied. However, the results of such rigid rules are often not satisfactory in practice in that there has been little serious study with respect to the relationship between the root cause of a QoS violation and an observed violation phenomenon. This paper introduces a statistical approach to the analysis of QoS violations. They propose and validate through experiments that: (1) a type of QoS violation will present consistent symptoms in terms of the observed application performance and end-to-end traffic pattern. Such a violation can be recognized once the similar symptoms repeat during a QoS session. (2) QoS violations of different nature (e.g., caused by shortage of different resources) will present diverse symptoms. Using a set of end-to-end statistics, they are able to describe and differentiate between QoS violations. They propose a fast orthonormal algorithm for real-time training/classification of QoS violations and prove that this algorithm is universal approximation. They also extend the scope of hidden neurons from kernel functions to additive functions for higher classification accuracy.

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