TELECOMMUNICATION SYSTEMS

MODELING, ANALYSIS, DESIGN AND MANAGEMENT

Available online
www.springerlink.com

Editor-in-Chief:
Bezalel Gavish

Special Issue:
MULTIMEDIA STREAMING OVER NEXT GENERATION TELECOMMUNICATION NETWORKS

Guest Editors:
Theodore Zahariadis and Rigobert Foka
Contents

Special Issue: Multimedia Streaming over Next Generation Telecommunication Networks

Guest Editorial
T. Zahariadis and R. Foka

A Novel End-to-End Architecture for H.264 Video Streaming over the Internet
A. Argyriou

Adaptive Resource Sharing Strategies for UMTS Multiservice Mobiles
M. Canales, Á. Hernández-Solana, J.R. Gállego and A. Valdivinos

QoS Provisioning with New Effective Bandwidth/Buffer Calculation Scheme in Wireless IP Networks
Y. Kim

Software-Based Video/Audio Processing for Cellular Phones
J.-H. Jeong and C. Yoo

Efficient De-Jitter Control for Voice Applications over Wireless Ad Hoc Networks
M. Benaisa, V. Lecuire, F. Lepage and A. Schaff

Enabling Real-Time H.264 Video Services over Wireless Ad Hoc Networks Using Joint Admission and Transmission Power Control
Y. Pei, V.S. Ambetkar, J.W. Modesto, Q. Qu and X. Wang

Heuristic and Hybrid Methods for Solving Optimal Multiple Multicast Problem on WDM Ring Network
D.-R. Din
Multimedia Streaming over Next Generation Telecommunication Networks

Guest Editorial

Streaming real-time multimedia traffic over the Internet is gaining impetus in the communications and entertainment industries. Improvements and innovations in the wide/metropolitan, local/access, and enterprise/home network technologies aim to bring the information superhighway to an increasing number of users worldwide in affordable cost. Recent measurements indicate that in the last couple of years, Internet traffic continued to grow at 60%-80% annually, while broadband and wireless subscribers grew at an average rate of 60% and 40%, respectively. At the same time, research efforts and developments in mobile/cellular networks, including the Third Generation Partnership Project (3GPP) and the 3GPP2, are also fostering IP telecommunication services and multimedia services allowing mobile operators to introduce next generation communication applications and services like video telephony, instant messaging, live streaming and chat, etc, competing with existing Internet Service Providers (ISPs) and Application Service Providers (ASPs). The net effect of these driving forces is a set of new requirements that are placed on the evolution of the major telecommunications networks, called "Next Generation Networks" (NGN).

The term NGN is very broad indeed. Almost any development in data networking could potentially be placed under this banner. A formal description by ETSI’s NGN Starter Group defines NGN as "... a concept for defining and deploying networks, which, due to their formal separation into different layers and planes and use of open interfaces, offers service providers and operators a platform which can evolve in a step-by-step manner to create, deploy and manage innovative services" [Kiácz, 2].

NGN has been more commonly associated with voice – a vision for the future of packet-based voice networks as part of the evolution from today’s circuit switched voice networks. For the majority of both incumbent and alternative operators, offering a mix of voice and data services, voice is still contributing over 80% of revenues [1], and this may not change in the near future (figure 1). However, carriers worldwide are facing decreasing Average Revenues per User (ARPU) and due to the fierce competition in the voice and Internet access services, carriers’ margins are being reduced. The later forced them to identify attractive multimedia services that can be bundled together with their basic offerings. Though there is not yet defined a real “killer application” [Middleton, 3], the most foreword looking ones are touted to be multimedia based, optimised over the IP layer. Examples of NGN streaming applications include IP telephony, broadband data
and Internet access, multimedia broadcasting (Radio or TV broadcast) and various interactive applications such as multi-party (video-)conference, (near) Video on Demand, on-line collaboration, instant messaging, and multiplayer games.

Supporting streaming multimedia applications and services over next generation wireless and wireline telecommunication networks is challenging due to constraints such as high heterogeneity, high-rate limited bandwidth, randomly time-varying network interference, stringent quality of service (QoS) requirements, interoperability, etc. Aiming to present state-of-the-art research and developing activities contributing to all facets of multimedia streaming across next generation all-IP networks, we start this Special Issue with the paper entitled: "A Novel End-to-End Architecture for H.264 Video Streaming over the Internet," by Antonios Argyriou. The paper proposes an end-to-end architecture, which combines the network-friendly H.264 specification with the Stream Control Transmission Protocol (SCTP). Via simulations, it is shown that when H.264 and SCTP are coupled together, they are capable of maintaining good perceptual quality of unicast video streaming and TCP-friendliness under various loss conditions.

The next group of papers targets next generation all-IP wireless/cellular communications. To support and satisfy QoS of diverse IP-based multimedia applications over wireless/cellular NGN, traffic management, such as resource allocation and Connection Admission Control (CAC), becomes essential. The paper entitled: "Adaptive Resource Sharing Strategies for UMTS Multiservice Mobiles," by María Canales et al., proposes and evaluates a resource sharing and multiservice transmission scheme, which efficiently joins voice, video and interactive games over UMTS, taking into account each service specific Quality of Service (QoS) requirements. In order to calculate each service transmission rate, the proposed selection strategy takes into account the buffer occupation, delay requirements and target bit rate. Simulation results show that the proposed resource sharing strategy provides balanced performance of the multiplexed services. The special issue continues with the paper entitled: "QoS Provisioning with New Effective Bandwidth/Buffer Calculation Scheme in Wireless IP Networks," by Yongjin Kim, which
aims to tackle the combination of QoS, CAC, resource allocation and terminal processing load. The paper proposes a bandwidth/buffer calculation method based on a virtual channel/buffer analysis scheme. It is shown that the proposed method can achieve high resource utilization efficiency with reduced processing load. The next paper entitled: “Software-Based Video/Audio Processing for Cellular Phones,” by Jin-Hwan Jeong and Chuck Yoo, also faces the processing power restrictions of the NGN mobile terminals. Though current cellular phone’s processing power is sufficient for most data applications, software-based multimedia (video/audio) processing is quite challenging. To develop a solution for low-end and mid-tier cellular phones, the paper analyzes the complexity of existing video standards, studies various coding profiles as combinations of subalgorithms, and proposes a profile that adapts its complexity to the processing power of current cellular phones. The profile along with an out-of-order dithering algorithm are implemented and evaluated on a cellular phone software environment.

The special issue continues with two papers that respectively target voice and video issues over wireless ad hoc networks. Most Voice-over-IP (VoIP) applications require a playout buffer at the receiver side to smooth network delay variations. However, algorithms for dynamic playout adjustment designed for wireline networks do not operate efficiently over wireless ad hoc networks, as they estimate the end-to-end delay based on previous received audio packets. This technique is not appropriate for ad hoc wireless networks due to mobility and random changes of the network topology. The paper entitled: “Efficient De-Jitter Control for Voice Applications over Wireless Ad Hoc Networks,” by M. Benaissa et al. proposes a delay estimation method and an algorithm for playout delay adjustment based on the Route Request control messages of the AODV routing protocol. The simulation shows that the proposed algorithm outperforms existing playout delay adjustment algorithms. The next paper entitled: “Enabling Real-Time H.264 Video Services over Wireless Ad Hoc Networks Using Joint Admission and Transmission Power Control,” by Yong Pei et al. investigates the capacity of a wireless ad hoc network in supporting packet video transport. The paper investigates how the time delay of hop-by-hop transmission affects the video throughput and how to provide a time-delay bounded packet video delivery service over such a network. The analytical results indicate that appropriate joint admission and power control have to be employed in order to efficiently utilize the network capacity while operating under the delay constraint as the distance between source and destination changes.

We close this special issue with a paper that looks forward into future wireline NGN technologies. The paper entitled: “Heuristic and Hybrid Methods for Solving Optimal Multiple Multicast Problem on WDM Ring Network,” by Der-Rong Din, considers the Optimal Multiple Multicast Problem (OMMP) on Wavelength Division Multiplexing (WDM) ring networks without wavelength conversion. When the physical network and the set of multicast requests are given, OMMP is the problem that selects a suitable path (or paths) and wavelength (or wavelengths) among the many possible choices for each multicast request such that not any pair of paths using the same wavelength passes through the same link. In this paper, the OMMP is divided into two subproblems: path routing and wavelength assignment subproblems. For each subproblem, two heuristic
algorithms are proposed. Moreover, a hybrid method, which combines heuristic and simulated annealing algorithm is proposed to find the near optimal solution. Experimental results indicate that these algorithms are efficient.

Before we leave you to enjoy this special issue, we would like to thank all authors for their valuable contributions and also all reviewers, who dedicated their precious time in providing numerous comments, suggestions and corrections. Last but not least, we would also like to acknowledge the enlightening support of Editor-in-Chief, Bezalel Gavish and his team. Having the support of all of them, we believe that most of our expectations have been fulfilled and we hope that this special issue offers a considerable contribution in the area of “Multimedia Streaming over Next Generation Telecommunication Networks”.

Theodore Zahariadis
Ellemedia Technologies

Rigobert Foka
Thales Communications

References