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# Multiview Real-Time Media Distribution for Next Generation Networks

Hugo Marques [a,b,c,*], Hélio Silva[b], Evariste Logota[b], Jonathan Rodriguez[b], Seiamak Vahid[a], Rahim Tafazolli[a]

[a] Centre for Communication Systems Research, University of Surrey, Surrey, United Kingdom
[b] Instituto de Telecomunicações, Campus de Santiago, Aveiro, Portugal
[c] Instituto Politécnico de Castelo Branco, Castelo Branco, Portugal

## Abstract

With the massive deployment of broadband access to the end-users, the continuous improvement of the hardware capabilities of end devices and better video compression techniques, acceptable conditions have been met to unleash over-the-top bandwidth demanding and time-stringent P2P applications, such as multiview real-time media distribution. Such applications enable the transmission of multiple views of the same scene, providing consumers with a more immersive visual experience. This article proposes an architecture to distribute multiview real-time media content using a hybrid DVB-T2, client-server and P2P paradigms, supported by an also novel QoS solution. The approach minimizes packet delay, interarrival jitter, inter-ISP traffic and traffic at the ISP core network, which are some of the main drawbacks of P2P networks, whilst still meeting stringent QoS demands. The proposed architecture uses DVB-T2 to distribute a self-contained and fully decodable base-layer video signal, assumed to be always available to the end-user, and an IP network to distribute in parallel - with increased delay - additional IP video streams. The result is a decoded video quality that adapts to individual end-user conditions and maximizes viewing experience. To achieve its target goal this architecture: defines new services for the ISP's services network and new roles for the ISP core, edge and border routers; makes use of pure IP multicast transmission at the ISP's core network, greatly minimizing bandwidth consumption; constructs a geographically contained P2P network that uses P2P application-level multicast trees to assist the distribution of the IP video streams at the ISP access networks, greatly reducing inter-ISP traffic, and; describes a novel QoS control architecture that takes advantage of the Internet resource over-provisioning techniques to meet stringent QoS demands in a scalable manner. The proposed architecture has been implemented in both real test bed implementation and ns-2 simulations. Results have shown a highly scalable P2P overlay construction algorithm, with very fast computation of application-level multicast trees (in the order of milliseconds), and efficient reaction to peer-churn with no perceptually annoying impairments noticed. Furthermore, enormous bandwidth savings are achieved at the ISP core network, which considerable lower management and investment costs in infrastructure. The QoS based results have also shown that the proposed approach effectively deploys a fast and scalable resource and admission control mechanism, considerably lowering signalling events using a per-class over-provisioning approach thus preventing per-flow QoS reservation signalling messages. Moreover, it is aware of network link resources in real-time and supports for service differentiation and network convergence by guaranteeing that each admitted traffic flow receives the contracted QoS. Finally, the proposed architecture for Multiview Real-Time Media Distribution for Next Generation Networks, as a component for a large project demonstrator, has been evaluated by an independent panel of experts following ITU recommendations, obtaining an excellent evaluation as computed by Mean Opinion Score.
Keywords: 3D, application-level multicast, content delivery networks (CDN), DVB-T2, IP

multicast, multiview, peerto-peer (P2P), P2P-CDN, Quality of Service (QoS), QoS overprovisioning, video streaming.

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