Chapter 12
Routing and Coding Enhancements to Improve QoS of Video Transmissions in Future Ad Hoc Networks

Juan C. Guerri
UPV, Spain

Pau Arce
UPV, Spain

Patricia Acelas
UPV, Spain

Wilder E. Castellanos
UPV, Spain

Francisco Fraile
UPV, Spain

ABSTRACT

Video services are much demanded nowadays but bandwidth and delay requirements of this kind of services are very restrictive. Offering real-time video services in wireless ad-hoc networks is not an easy task because of the difficulty of guaranteeing certain quality in a shared medium. Practical solutions should try to improve communications at (and gathering information from) several layers of the protocol stack. Mobile Ad-hoc Networks are infrastructure-less wireless networks characterized by being very versatile, dynamic and self-organized but also by the difficulty to achieve a good Quality of Service in video transmissions due to packet losses and node mobility. On the other hand, the Wireless Mesh Network is presented as the next step in wireless networks. Wireless Mesh Networks have a hierarchical topology, clustered structure and static backbone, which all help to improve the network stability. In the way towards Wireless Mesh Networks, hierarchical routing protocols could transform an ad-hoc network in a more robust wireless network. Therefore, in this chapter, hierarchical routing protocols

DOI: 10.4018/978-1-61350-144-3.ch012
have been studied, particularly Hierarchical Optimized Link State Routing Protocol, and compared with a traditional flat routing protocol named Optimized Link State Routing. Furthermore, additional video coding techniques have been used in order to improve video quality in reception. At application layer, results show that Multi-description Coding achieves better quality on video transmissions when nodes have medium or high mobility, especially when using multipoint-to-point transmission or disjoint paths in a hierarchical structure. Video trace simulations have allowed us to perform subjective quality tests to assert the Quality of Experience improvements in video transmissions.

**INTRODUCTION**

Video transmission with Quality of Service (QoS) over IP networks has been discussed for decades and has become the main topic in many papers and research works. Studies carried out by researchers years ago such as Little (Little & Venkatesh, 1994), Bolot (Bolot & Turletti, 1994), Schulzrinne (Busse, Deffner & Schulzrinne, 1996) and Steinmetz (Steinmetz, 1990) triggered a process that allowed the publication and use of standards (which should be considered a great success) such as Real-time Transport Protocol (RTP) / Real-time Control Protocol (RTCP), Real Time Streaming Protocol (RTSP), Session Initiation Protocol (SIP), Session Description Protocol (SDP)… and, moreover, it provoked an evolution in compression systems more and more efficient such as Scalable Video Coding (SVC) included in the norm H.264 (H.264/SVC). Furthermore, the emergence of the concept of “new content generator” associated with any user (youtube being the best example of the new content generation model) has also led to the widespread use of pseudo streaming solutions based on HyperText Transfer Protocol (HTTP), proprietary solutions such as Flash Video or open solutions such as HyperText Markup Language version 5 (HTML5) video, which initially appear to resolve the expectations of users. Moreover, the transmission using the High Definition (HD) standard, the imminent appearance of 3D television (3D-TV) or enhanced immersive interactive user-based applications, will entail a change in the design of traditional networks, increasing the network intelligence in order to avoid over-provisioning and guarantee QoS.

However, there are some proposals for network topologies that are far away from supporting this kind of services. Ad Hoc networks, especially Mobile Ad Hoc Networks (MANETs), and its integration in Wireless Mesh Network (WMN) are examples of these networks. Currently, it is only possible to guarantee a minimum connectivity service between mobile nodes in an ad hoc network, despite the great amount of works that have been carried out about this topic. The possibility of offering a video streaming service with good QoS and a good Quality of Experience (QoE) to final users is still complicated. The support of a good QoS and QoE for HD or 3D-TV services is still a bigger challenge.

As a starting point we will use the typical definition of MANET, i.e. a group of independent nodes, interconnected through wireless links without using network infrastructure or centralized administration. Due to nodes mobility, the topology is dynamic and unpredictable. The network can work in isolated mode or being connected to a network infrastructure like the Internet. Routes between nodes may include multiple hops forming a multi-hop wireless ad hoc network.

The theoretical advantages that ad hoc networks bring are well-known. Among these advantages, we can highlight their easy configuration and their ability to establish a communication path using the proper routing protocols between any nodes of the network without using a central element. In many situations such as catastrophes or emergencies in
Related Content

An Overview of Maritime Wireless Mesh Communication Technologies and Protocols

Consumer Usage of Broadband Internet Services: An Analysis of the Case of Portugal
[www.igi-global.com/chapter/consumer-usage-broadband-internet-services/48306?camid=4v1a](www.igi-global.com/chapter/consumer-usage-broadband-internet-services/48306?camid=4v1a)

Cost-Based Congestion Pricing in Network Priority Models Using Axiomatic Cost Allocation Methods
[www.igi-global.com/chapter/cost-based-congestion-pricing-network/6042?camid=4v1a](www.igi-global.com/chapter/cost-based-congestion-pricing-network/6042?camid=4v1a)

QoS-Aware Service Selection and Multicast Framework for Wireless Mesh Networks