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A New Transport Protocol for Broadcasting/Multicasting MPEG-2 Video Over Wireless ATM Access Networks

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Abstract. Because of the telecommunications de-regulation act and progress in wireless technologies, we will see the co-existence of heterogeneous broadband access infrastructures in the broadband video service industry in the near future. In this paper, we addressed the error control issue when transmitting MPEG-2 video streams over wireless access networks for broadband video broadcast or multicast services. An end-to-end transport protocol based on ATM and wireless ATM technologies is proposed. For video services, the underlying transport network should be transparent and quality should be maintained uniformly over all the segments whether wireline or wireless links. For network resources to be used efficiently, error control should be applied locally on the wireless segments so as to avoid the excessive overhead over the reliable wireline portions. Because a broadband video broadcast or multicast service is a one-to-multiple point service, FEC is the most prevalent error control mechanism. Due to the important role of MPEG-2 control information in the decoding process, priority MPEG-2 control information has to be differentiated from MPEG-2 data information, and excess error protection has to be allocated to it in order to achieve satisfactory QoS. Therefore, a header redundancy FEC (HRFEC) scheme for error control is applied at the local distribution centers before the MPEG-2 encoded video streams are transmitted over the wireless channels. HRFEC is an FEC-based selective protection scheme, which allocates extra error protection to important control information. Simulation results show that the quality of the reconstructed video sequence is vastly improved by using HRFEC, when the channel condition is poor.

Keywords: MEPG-2 broadcast/multicast, real-time, FEC, header redundancy, WATM, video quality

1. Introduction

1.1. Access networks

During the past several years, there has been an increasing demand for broadband digital video services, such as digital TV, pay-per-view, video conferencing, and video on demand. In addition, the 1996 Telecommunication Deregulation Act allows different service providers (telephone, television, CATV and new entrants) to compete in each other's territory to provide broadband services to potential residential and business customers. It has propelled the need to find fast deployable and cost effective solutions to enable market penetration as soon as possible. Currently, the major competing broadband access technologies or infrastructures include xDSL (Digital Subscriber Loop), FTTC (Fiber to the Curb), HFC (Hybrid Fiber Cable), FTTH (Fiber to the Home), broadband wireless access networks (B-WANs) and satellite networks [5]. In the near future, it is most likely that we will see the co-existence of these heterogeneous broadband access technologies or infrastructures in the broadband video service industry.

One major subclass of B-WANs consists of broadband fixed wireless access networks (B-FWANs), which are very likely to be deployed to serve residential and business customers, since, for most broadband video services, mobility is not a top-priority issue. Currently, there are two major B-FWAN candidates for broadband services to the home or office: Local Multipoint Distribution/Communication System (LMDS/LMCS) and Multichannel Multipoint Distribution System (MMDS). Both LDMS and MMDS are proposed to distribute high quality digital video and offer fast Internet access using low power, high frequency or millimeter wave (MW) radio signals over short to medium distances. They both use a cellular service structure, which is similar to that used in cellular phone service systems. The major differences between them include spectrum bands, the size of service cells, and one-way or two-way wireless services. LMDS uses the 28 GHz band while MMDS uses the 2.15–2.682 GHz. The cell radius of a typical MMDS cell is around 25 to 35 miles while that of LMDS is around 1 to 3 miles depending on terrain and antenna placement. LMDS is proposed to offer two-way services in one infrastructure, whereas MMDS requires terrestrial wired networks for upstream traffic (from users to the base stations) [9].

1.2. MPEG-2 video broadcast/multicast system

Figure 1 shows the broadband video broadcast or multicast scenario considered in this paper. In order to save on storage space and channel resources, video programs are compressed (or encoded) using the MPEG-2 standard [4] at the source, before they are broadcast or multicast to residential or business users at different locations. Users in different ar-