Chapter 1

Adaptive Multimedia Services in Next-Generation Broadband Wireless Access Network

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ABSTRACT

There is a massive upsurge in data traffic over the Internet due to multimedia services. The upcoming heterogeneous broadband wireless access networks (BWANs) provide higher data rates, increased capacity, and enhanced network coverage. Since the smartphone usage and multimedia service demand is increasing at a much faster pace as compared to the capacity and resources of the underlying network technology, adaptive multimedia services are essential to provide satisfactory quality of experience (QoE). The focus of this chapter is to discuss the adaptive techniques to provide better multimedia services to heterogeneous users in next-generation networks. These techniques consist of video streaming optimization using MPEG-DASH, video caching schemes, quality aware video transcoding, web optimization of multimedia services, and user-centric cross-layer optimization.

INTRODUCTION

More than 66% of the data traffic over internet is consumed by video streaming, according to Begen et al. (2011). According to Cisco, video streaming will constitute 72% of Global mobile data traffic by 2019. Video streaming unlike the other web applications largely depend on the streaming rates. Wireless service providers are offering an increasing number of video streaming services to the users. The diversity in wireless network infrastructure and user equipment specification has introduced new challenges for service providers to deliver acceptable quality of experience (QoE) to users. Enhancing the QoE for the users that are accessing multimedia services over wireless networks, is a topic of interest in recent
Multimedia services in next generation wireless networks will be able to ensure an improved QoE by employing the following optimization techniques that have been discussed at length in this chapter.

1. **Video Streaming Optimization Using MPEG-DASH**: In this module, we emphasize on the adaptive multimedia services using MPEG-DASH over the next generation broadband wireless network that promises high quality of service (QoS) with improved user experience. The basis architecture of MPEG-DASH and different ways of estimating the channel throughput are described.

2. **Video Caching for Efficient Utilization of Network Resources**: Two main applications of video caching for efficient utilization of network resources are examined in this study, one is Hierarchical web caching in Internet-based vehicular ad hoc networks (IVANET) and other is on Collaborative web caching through resource auctions among two or more wireless service providers (WSPs).

3. **Quality Aware Video Transcoding**: Video transcoding is a process of scaling the video either spatially or temporarily. Two methods of video transcoding for efficient delivery of multimedia content over wireless network are discussed namely Dependency aware distributed video transcoding in cloud and Optimal H.264/AVC video transcoding system.

4. **Web Optimization of Multimedia Services**: In this module, we differentiate mobile web browsing from PC web browsing. The architecture of mobile web browser and its limitations are discussed. Two main optimization techniques namely client side optimization and cloud based optimization is studied. The concept of mobile accelerator is described.

5. **User-Centric Cross-Layer Optimization**: Different user-centric adaptation techniques based on wireless channel condition are explained. The simulation results show the applicability of the techniques for LTE network. The user-centric feedback model is presented in this module. The performance of the proposed method is validated using simulation result.

### VIDEO STREAMING OPTIMIZATION USING MPEG-DASH

Multimedia content is effectively delivered in a cost-effective manner using HTTP streaming (Begen et al., 2011). Dynamic Adaptive Streaming over HTTP (DASH) is a new standard developed in this regard, by Motion Picture Experts group (MPEG) and Third Generation Partnership Project (3GPP). Conventionally streaming is based on a client-server model that uses real time streaming protocol (RTSP). The server keeps a track of the connected client state till the session completes or the client disconnects. The media is transmitted from the server as a continuous stream of packets using transmission control protocol (TCP) or user datagram protocol (UDP).

The conventional streaming uses progressive download technique that has the following disadvantages:

1. Wastage of bandwidth if the user discontinues watching the content (or switches to other content) after the progressive download has started.
2. Bitrate is not adaptive.
3. It does not support live multimedia services.