Chapter 9
Optimizing Path Reliability in IPTV Systems Using Genetic Algorithm

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ABSTRACT

IPTV system is meant to provide TV services through IP networks. IPTV is a next generation technology and is growing rapidly day by day across the globe. Providing TV services through IP networks reflects the audio-video service through the IP networks in IP format. TV packets are media and real-time packets in nature, therefore delivering these packets through the IP network is a big challenge. It needs to be done with utmost care and reliably for the timely delivery of these packets to ensure reliable packet transfer is a big issue in IPTV systems. Reliability, in such systems, depends on the failure rates of various components through which the packet passes. This chapter addresses the reliability issue in IPTV systems and suggests a possible solution to maximize it using Genetic Algorithms. The proposed model explores for the most reliable path among many available paths for the packet delivery. It helps in deciding the best available route passing through which reliability is maximized. Experimental results reveal the efficacy of the model.

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INTRODUCTION

Services provided over the Internet, have increased in recent years with the evolution in networks technologies such as WiFi, WiMAX etc. Network devices that access these services have also increased. New forms of services for end users have been introduced in the interconnected communication infrastructure. Among such new services is IPTV, which provides TV services over IP-based networks. IPTV services are usually available as a combination of the three services consisting of video, audio and data (usually referred as triple play). The video component of IPTV triple play consists of Video on Demand (VoD) and broadcast TV, the audio component consists of Voice over IP (VoIP), and the data component consists of standard HTTP based applications. Triple play and Internet traffic are routed using uni-cast routing, while broadcast TV traffic is routed using multicast routing (Cha, Choudhury, Yates, Shaikh, & Moon, 2006). IPTV traffic, particularly VoD, constitutes a significant portion of the network traffic and has very stringent Quality of Service (QoS) and Quality of Experience (QoE) requirements.

Figure 1 shows the structure of IPTV system which consists mainly of IPTV head end, IP network (transport network), and Set Top Box (STB) users.

In IPTV system, IPTV head end is the video source where the signal is first encoded using some coding scheme, such as H.264 (Lee, Lee, Kim, & Shin) codec. By this encoding of the TV signal, the output bit rate of the source video signal is reduced. The compression performance of the H.264 is much higher than MPEG-2. Therefore, the encoder in the head end plays an important role in end to end video system. After coding, the output bit stream is encapsulated using Real-Time Protocol (RTP) which guarantees ordered delivery over an unreliable Internet Protocol (IP) network. The RTP data are generally encapsulated in User Datagram Protocol (UDP) and IP headers and then replicated in an IP network. The reliability of the data packet flow is decided by the reliability of the network routers and connecting links. The transport network is used to transmit the data coming from the head end based on the IP protocol. The role of transport network is to classify the packet and realize the queue-scheduling algorithm. The transport network delivers the data to the STBs of the subscribing consumers. The video receiver is used to decode the stream correctly from the transport network and then play it to the subscriber.

Reliability issue has been rarely addressed in IPTV systems, in general. (Kandavanam, Botvich, & Balasubramaniam, 2009) suggest a model for maximizing QoS assurance in IPTV has been proposed. The model combines the use of GAVNS algorithm (Genetic Algorithm with Variable Neighborhood Search) with the efficient

Figure 1. IPTV system structure