

Bandwidth Efficient IPTV Distribution

- On Error Resilience and Fast Channel Change

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Abstract

Television is now changing its traditional distribution forms to being distributed digitally over broadband networks. The recent development of broadband Internet connectivity has made the transition to Internet Protocol Television (IPTV) possible. When changing distribution technique of an existing service, it is important that the new technique does not make the service worse from the user's point of view. Although a broadband network offers high capacity and has excellent performance there will be occasional packet losses and delays which could negatively influence the user experience of the delivered broadband service. Since bandwidth is a key constraint for video distribution there is a strong incentive for finding schemes to increase bandwidth utilization, especially when distributing high bandwidth IPTV services. In digital video coding it is common to use predictive coding to remove temporal redundancy in video sequences. This technique greatly increases the coding efficiency but makes the sequence more sensitive to information loss or delay. In addition, the use of predictive coding also introduce a inter frame dependency which could make the channel change significantly slower.

This thesis addresses two important areas related to bandwidth efficient IPTV distribution, namely error resilience and fast channel change. A method to numerically estimate the decoded objective video quality of scalable coded video is presented and evaluated. The method can be used to estimate objective video quality for a scalable video transmission system subject to packet-loss. The quality gain of temporally scalable video in a priority packet dropping environment is also investigated and quantified. Synchronization Frames for Channel Switching (SFCS) is proposed as a method to code and distribute video with IP-multicast, which can be used to efficiently combat packet-loss, increase bandwidth utilization, and offer a channel change speed up. The performance of SFCS is analyzed and bandwidth estimation expressions are formulated, analytical results are complemented with computer simulations. The results show that SFCS deployed in an IPTV delivery system can significantly lower the bandwidth consumption and speed up the channel change.

Key words: IPTV, Bandwidth, Fast channel change, Error resilience