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ADAPTIVE END-TO-END DELAY EQUALIZATIONS FOR TCP VIRTUAL PATH TRANSMISSIONS IN INTERNET ENVIRONMENTS

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Abstract. *In the Internet networks, packets can be transmitted without loss provided that the network load remains sufficiently low. However, due to the bursty nature of many Internet-based applications, practical networks frequently experience a congestion problem, which increases the end-to-end delay and causes a significant degradation of the system performance. Accordingly, first, this study proposes a generic method for optimizing the end-to-end delay of a single TCP (transmission control protocol) virtual path in the Internet environment. Second, a delay equalization due to the multi-virtual paths based on optimizations is performed. Consequently, a technique is then proposed for equalizing the transmission delays of the multiple TCP virtual paths in a single source-destination node pair. For analysis purposes, the virtual path is considered to comprise bridge and non-bridge edges [5]. An assumption is made that the overall delay between the source and destination nodes is dominated by the delays incurred at the bridge edges in the virtual path. Accordingly, in the proposed delay control method, the transmission delay is optimized by applying a suitable weighting factor to the bridge edges within the transmission path. It is shown that the proposed method improves the playback speed at the receiving end and effectively compensates for the burstiness at the sending end, thereby improving the overall QoS (quality of service) provided by the network to the TCP application.*

Keywords: Bridge, Non-bridge, Virtual path, Optimal delay, Weighing factor

1. **Introduction.** TCP is the dominant traffic protocol in modern communication networks. The transmission efficiency of TCP traffic depends on the virtual path selected from the network topology. However, in the modern Internet environments, the network topology changes continuously as a result of the arrival of new connections and the termination or rerouting of existing connections. Consequently, a requirement exists for sophisticated schemes capable of maintaining the QoS of the TCP application by modifying the transmission path adaptively in response to changes in the network configuration.

The performance of many Internet-based applications is critically dependent upon the satisfaction of certain pre-defined delay guarantees and system throughput targets. For example, a video flow may require a certain minimum forwarding rate to be achieved in order to ensure a continuity of the pictures, while an interactive audio flow may specify some maximum delay bound for the transmission packets. For example, high quality voice communications such as those performed using VoIP (Voice over Internet Protocol) require the packets to arrive at the receiving end within a certain threshold period. Therefore, in the heterogeneous environments characteristic of modern communication systems, the problem of delay guarantee provisioning in an end-to-end fashion is a critical concern.