

IMPROVING END-TO-END COMMUNICATION PERFORMANCE BY CONTROLLING BEHAVIOR OF INTERMEDIATE NETWORK NODE

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ABSTRACT. *In this paper, we address the problem of improving end-to-end performance in exchanging packets through the Internet by better management of queuing behavior of network nodes. We present a new network queue control algorithm and compare it with several network queue control algorithms in literature in terms of end-to-end performance metrics including packet delay, delay jitter and packet loss ratio. Our experiments show that an intermediate network node using our algorithm may deliver better end-to-end performance than others at the cost of reduced link utilization at the node.*

Keywords: Active queue management, Congestion control, Internet protocol, Computer networks

1. **Introduction.** Networked Control Systems (NCSs) is an emerging research area in which network delays, packet loss, communication bandwidth limitation, data rate constraints are explicitly taken into account in designing a control system. Wang and Sun [18] modeled NCS as an H^∞ control problem and presented the linear matrix inequality approach as a solution. Zhao *et al.* [21] proposed a predictive control based approach to deal with a Wiener type system which is closed through a network. Their output feedback predictive controller is designed using delayed sensing data with a specially designed state observer. The network constraints, i.e., the packet delay and data packet loss, are compensated in both the forward and backward channels by taking advantage of the characteristics of both the predictive controller and the network transmission. Zhu *et al.* [22] proposed a controller design method by using the delay-dependent approach. They used Lyapunov functional candidate as a new criteria and derived the feedback gain of a controller by solving a set of Linear Matrix Inequalities (LMIs). They also investigated the correlation between network delay and time delay in the plant. Mao and Jiang [12] investigated the problem of diagnosis of actuator/component faults for a class of networked control systems using adaptive observer techniques. An NCS may be benefited from improving end-to-end performance, such as network delay and packet loss, of transmitting data packets among its various components.

In literature, prevention of network congestion has been one of the themes in improving quality of network services. Network congestion occurs when “the total sum of demands on a resource is more than its available capacity” [11]. In a network, resources include link bandwidth and buffer in intermediate network nodes, such as switches and routers.