KYBERNETIKA — VOLUME 44 (2008), NUMBER 3, PAGES 336-359

Flow Control in Connection-Oriented Networks: A Time-Varying Sampling Period System Case Study

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Abstract: In this paper congestion control problem in connection-oriented communication network with multiple data sources is addressed. In the considered network the feedback necessary for the flow regulation is provided by means of management units, which are sent by each source once every M data packets. The management units, carrying the information about the current network state, return to their origin round trip time (RTT) after they were sent. Since the source rate is adjusted only at the instant of the control units arrival, the period between the transfer speed modifications depends on the flow rate RTT earlier, and consequently varies with time. A new, nonlinear algorithm combining the Smith principle with the proportional controller with saturation is proposed. Conditions for data loss elimination and full resource utilisation are formulated and strictly proved with explicit consideration of irregularities in the feedback information availability. Subsequently, the algorithm robustness with respect to imprecise propagation time estimation is demonstrated. Finally, a modified strategy implementing the feed-forward compensation is proposed. The strategy not only eliminates packet loss and guarantees the maximum resource utilisation, but also decreases the influence of the available bandwidth on the queue length. In this way the data transfer delay jitter is reduced, which helps to obtain the desirable Quality of Service (QoS) in the network.

Keywords: congestion control; connection-oriented networks; sampled data systems; variable sampling period;

AMS Subject Classification: 93A30; 93C57; 94A20;

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