Timing Analysis of Rate Constrained Traffic for the TTEthernet Communication Protocol

Ethernet is a low-cost communication solution offering high transmission speeds. Although its applications extend beyond computer networking, Ethernet is not suitable for real-time and safety-critical systems. To alleviate this, several real-time Ethernet-based communication protocols have been proposed, such as TTEthernet, which is the focus of this paper. TTEthernet is suitable for mixed-criticality systems both in the safety and temporal domain. TTEthernet offers three traffic classes: static time-triggered (TT) traffic, dynamic traffic with bounded transmission rate (called "Rate Constrained", RC), and unbounded dynamic traffic ("Best-Effort", BE). In this paper we propose a novel worst-case end-to-end delay analysis of the RC traffic for TTEthernet systems. The proposed technique considerably reduces the pessimism of the analysis, compared to existing approaches. We have evaluated the new analysis using several test cases.