EVALUATION AND IMPROVEMENT OF RESPONSE TIME BOUNDS FOR REAL-TIME APPLICATIONS UNDER NON-PREEMPTIVE FIXED PRIORITY SCHEDULING

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ABSTRACT: *Real-time applications must be guaranteed with a bounded response time. The two main approaches for computing the upper bounds are worst-case schedulability analysis and Network Calculus, both are based on the analysis of a deterministic majoring trajectory. The first one is issued from the result of Liu and Layland, and gives what is called the worst-case response time for a given set of periodic tasks scheduled with fixed priority. The second approach, proposed by Cruz, gives an upper bound on delay for a set of (σ,ρ)-bounded message flows. Both approaches could be used to evaluate the end to end delay bound in the industrial switched Ethernet (our target application) in which the main traffic is periodic with or without jitters. However, the use of either the worst-case trajectory or (σ,ρ) trajectory produces overestimated delay bounds. Therefore, in order to minimize this overestimation, we propose in this paper a comparative study of the delay bounds evaluated by both approaches for periodic (with or without jitters) arrival processes under Fixed Priority scheduling. For this purpose, a relationship is given between jitter and the maximum burst size for an optimal transposition from the classical task model to (σ,ρ)-constrained model. We also proposed a hybrid method to reduce the upper bound given Network Calculus for a multi-hop network. Numerical studies show the advantage of our method for reducing the estimation of the buffering requirement in each network element.*

KEYWORDS: *Worst-Case Response Time, Delay Bound, Burst, Jitter, Performance Evaluation*