Task- and Network-level Schedule Co-Synthesis of Ethernet-based Time-triggered Systems

Abstract:

In this paper, we study time-triggered distributed systems where periodic application tasks are mapped onto different end stations (processing units) communicating over a switched Ethernet network. We address the problem of application level (i.e., both task- and network-level) schedule synthesis and optimization. In this context, most of the recent works [10], [11] either focus on communication schedule or consider a simplified task model. In this work, we formulate the co-synthesis problem of task and communication schedules as a Mixed Integer Programming (MIP) model taking into account a number of Ethernet-specific timing parameters such as interframe gap, precision and synchronization error. Our formulation is able to handle one or multiple timing objectives such as application response time, end-to-end delay and their combinations. We show the applicability of our formulation considering an industrial size case study using a number of different sets of objectives. Further, we show that our formulation scales to systems with reasonably large size.
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