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Title: A Hardware-Aware Application Execution Model in Mixed-Criticality Internet of Things

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Abstract: The Real-Time Internet of Things is an emerging technology intended to enable real-time information communication and processing over a global network of devices at the edge level. Given the lessons learned from general real-time systems, where the mixed-criticality scheduling concept has proven to be an effective approach for complex applications, this paper formalizes the paradigm of the Mixed-Criticality Internet of Things. In this context, the evolution of real-time scheduling models is presented, reviewing all the key points in their development, together with some connections between different models. Starting from the classical mixed-criticality model, a mathematical formalization of the Mixed-Criticality Internet of Things concept, together with a specifically tailored methodology for scheduling mixed-criticality applications on IoT nodes at the edge level, is presented. Therefore, a novel real-time hardware-aware task model for distributed mixed-criticality systems is proposed. This study also offers a model for setting task parameters based on an IoT node-related affinity score, evaluates the proposed mapping algorithm for task scheduling, and presents some use cases.

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