Keynote talk

Challenges in Distributed Real-Time Systems: Scheduling and Synchronization

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Many emerging embedded real-time applications are increasingly networked, and operate under dynamic application contexts including uncertainties on activity behaviors (e.g., task arrivals, execution times, synchronization behaviors), non-deterministic communications, and node failures. This talk will focus on the end-to-end real-time scheduling and synchronization of time-critical software that operate in such contexts.

Multi-node, causally-dependent sequential behaviors can be scheduled, end-to-end, broadly, using two paradigms: independent scheduling, in which nodes independently construct schedules, and collaborative scheduling, in which nodes coordinate to construct system-wide schedules. While significant literature exists on independent scheduling, relatively less is known about collaborative scheduling and its concomitant tradeoffs. The talk will discuss recent research results in this space, in particular, collaborative schedulers designed using different distributed algorithmic paradigms (e.g., consensus, quorum, gossip), experimental implementations, and open challenges.

A major difficulty in distributed real-time programming is distributed synchronization. In particular, lock-based concurrency control's scalability, programmability, and composability challenges are exacerbated in distributed systems due to multi-node concurrency. Transactional memory has recently emerged as a promising alternative synchronization technique. The talk will argue distributed TM as a prospective distributed real-time synchronization abstraction, and will discuss recently developed techniques in this space and open challenges.