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Abstract

Multicore mixed-criticality with a hierarchical real-time scheduler and resource servers

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This is a real-time mixed-criticality system on a dual-core Linux desktop. The hardware/software architecture employs memory throttling so that modules can be isolated in execution as well as in analysis/certification.

There are two asymmetrically dedicated cores. A critical core runs a hierarchical scheduler (hs) with critical software: hard-coded, or Linux processes with associated metadata. The best-effort core runs arbitrary software.

The cores share DRAM and the memory bus. Best-effort activity can delay critical software. Interference is throttled/bounded to retain real-time computability.

When necessary, hs freezes/thaws best-effort core software. Task schedulers have budgets to bound memory interference. If depleted, the best-effort core is frozen whenever tasks from such a scheduler execute. Budgets are reset periodically.

The scheduling algorithm is a polled-preemptive EDF, with critical-group CPU budgets. Task model: sporadic.

Two resource servers uphold isolation in the face of shared resources: memory, and critical-core CPU time.

A memory experiment shows that best-effort core activity is throttled dynamically. Alas, the submission mechanism lacks precision in worst-case scenarios: hs is itself suspectible to best-effort interference, so the throttling mechanism can brake before it can effectuate.

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