

Work-Already-Published: Reliability Optimization on Multi-Core Systems with Multi-Tasking and Redundant Multi-Threading

Kuan-Hsun Chen, Georg von der Brüggen, Jian-Jia Chen

Department of Informatics
TU Dortmund University, Germany

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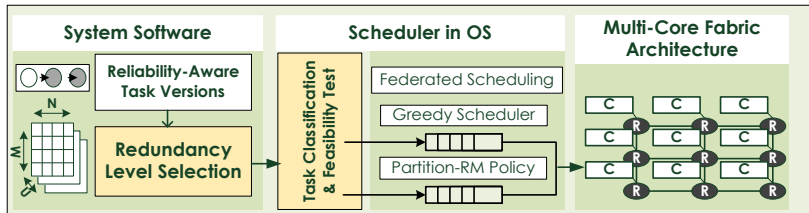
Introduction

Redundant Multi-threading (RMT) have been widely used.

- Simultaneous Redundant Threading (SRT) and
- Chip-level Redundant Multithreading (CRT)
- *Mixed Redundant Threading (MRT)* for balancing the costs

How to apply RMT while satisfying given design constraints?

- M homogeneous cores connected by a communication fabric
- N sporadic tasks with implicit deadline
- Preemptive fixed-priority scheduling



Why we prefer MRT?

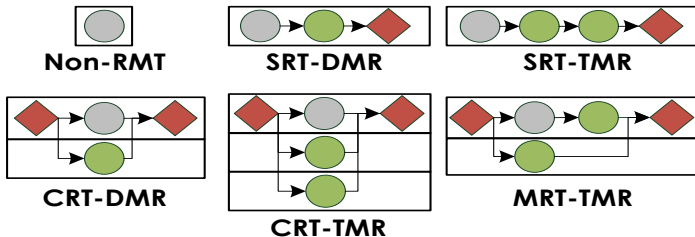


Figure: Each level has its own reliability penalty, which describes the probability that a fault during the execution leads to a visible error.

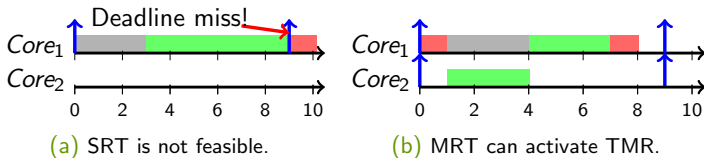


Figure: Triple Modular Redundancy-based RMT on two cores.

Summary and Takeaways

- Mixed-Redundant Threading balances the usage of resource.
- We solve the problem via dynamic programmings with Federated Scheduling.
- Our approach outperforms the greedy approach in terms of the system reliability and the feasibility.
- This study is limited to implicit-deadline real-time tasks under federated scheduling.