Latency, energy, and schedulability of real-time embedded systems

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Propositions belonging to the Ph.D. dissertation:

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by Di Liu

1. Let G be an application modeled as an acyclic Cyclo-Static Dataflow (CSDF) graph that is scheduled as a set of real-time periodic tasks onto a multi-core system. Optimizing the number of cores needed to schedule G under a latency constraint can be formulated as an integer convex programming problem. (Chapter 3)
2. Let G be an application modeled as an acyclic Cyclo-Static Dataflow (CSDF) graph that is scheduled as a set of real-time periodic tasks onto a cluster heterogeneous multi-core system. The frequency-driven mapping algorithm leads to less energy consumption without violating the throughput and latency constraints of G. (Chapter 4)
3. Let Γ be a set of periodic real-time tasks with implicit deadlines. By scheduling all tasks of Γ on a heterogeneous multi-core system, the C-D task splitting scheme achieves higher acceptance ratio than a partitioned approach with lower energy consumption. (Chapter 5)
4. The schedulability of an imprecise mixed-criticality system under the earliest-deadline-first scheduling algorithm with virtual deadlines can be checked in polynomial time. (Chapter 6)
5. The speedup factor of the imprecise mixed-criticality model under earliest-deadlines first with virtual deadline scheduling algorithm is 4/3. (Chapter 6)
6. The real-time system research should work on real-world industrially-relevant problems in order to have impact.
7. Real-time techniques will be a critical part of cloud computing.
8. For mixed-criticality systems, only models which reflect practical use-cases deserve research efforts from the academic community.
9. The flexibility and energy-efficiency make the heterogeneous system a promising platform for mixed-criticality systems.