

Bachelor/Master Thesis

Offloading Protocols for Multi-Mode Mixed-Criticality Systems

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For many resource-constrained systems such as IoT systems, driving assistance systems, and autonomous vehicles, it has become crucial to offload a certain amount of workload to other processing units, e.g., co-processors, GPUs or the cloud. However, since this approach is highly dependent on the reliability of the communication between the respective components or participants, it is sensible to either offload only non-critical tasks or to implement additional mechanisms that ensure the system safety and can be verified at system design time.

Systems of this kind comprise tasks with distinct criticality levels, i.e., with different timing requirements and consequences of their violation, and are typically modeled by the mixed-criticality model, which was first introduced by Vestal [3] in 2007 (a comprehensive survey on this topic was published by Burns and Davis [1]). Although the literature frequently focuses on so-called dual-criticality systems, i.e., systems with only two criticality levels, this concept does not necessarily comply with the industrial reality [2].

In this thesis, the student is expected to first explore the research landscape regarding

mixed-criticality systems and computation offloading and to thereon develop a safe offloading protocol for multi-mode mixed-criticality systems. Moreover, the student is expected to provide a formal analysis of the proposed model.

We also welcome other suggestions and related topics. Please do not hesitate to contact us.

References

- [1] Alan Burns and Robert I. Davis. A survey of research into mixed criticality systems. volume 50, pages 82:1–82:37, 2018.
- [2] Alexandre Esper, Geoffrey Nelissen, Vincent Nélis, and Eduardo Tovar. How realistic is the mixed-criticality real-time system model? In *Proceedings of the 23rd International Conference on Real Time and Networks Systems, RTNS '15*, pages 139–148, New York, NY, USA, 2015. ACM.
- [3] S. Vestal. Preemptive scheduling of multi-criticality systems with varying degrees of execution time assurance. In *28th IEEE International Real-Time Systems Symposium (RTSS 2007)*, pages 239–243, Dec 2007.