Simon Barner, Alexander Diewald, Jörn Migge, Ali Syed, Gerhard Fohler, Madeleine Faugère and Daniel Gracia Pérez. DREAMS Toolchain: Model-Driven Engineering of Mixed-Criticality Systems. In *Proceedings of the ACM/IEEE 20th International Conference on Model Driven Engineering Languages and Systems (MODELS '17)*, IEEE, 2017, pp. 259–269.

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Abstract:

Mixed-criticality systems (MCS) aim at boosting the integration density in safety-critical systems, resulting into efficient systems, while simultaneously providing increased performance. The DREAMS project provides a cross-domain architectural style for MCS based on networked, virtualized multi-cores controlled by hierarchical resource managers. However, the availability of a platform is only one side of the coin: deploying mixed-critical applications to shared resources typically requires design-time configurations (e.g., to ensure real-time constraints or separation constraints mandated by safety regulations). These configurations are the outcome of complex optimization problems which are intractable in a manual process that also hardly can guarantee the consistency of all deployable artefacts nor their traceability to the requirements. However, existing toolchains lack support for MCS integration, and particularly DREAMS' advanced platform capabilities. We present an integrated model-driven toolchain and the underlying metamodels covering all relevant aspects of MCS including applications, timing, platforms, deployments, configurations and annotations for extra-functional properties such as safety. The approach focuses on the left branch of the V-cycle, and ranges from product-line and design space exploration to resource allocation and configuration generation. We report on the integration of exploration tools and a reconfiguration graph synthesizer, and evaluate the resulting toolchains in two use cases consisting of a product-line of wind power control applications and an avionic subsystem respectively