# DEFESA DE TESE DE DOUTORADO

*Programa de Pós-Graduação em Ciência da Computação*

# SUPPORT TO RUN-TIME ADAPTATION BY A PUBLISH-SUBSCRIBE BASED MIDDLEWARE FOR MPSOC ARCHITECTURES

ALUNO: Jean Carlo Hamerski
ORIENTADOR: Dr. Alexandre de Morais Amory
BANCA EXAMINADORA: Dra. Débora da Silva Motta Matos (UERGS), Dr. Mateus Beck Rutzig (PPGCC/UFSM), Dr. César Augusto Missio Marcon (PPGCC/PUCRS)
DATA: 21 de março de 2019
LOCAL: Prédio 32, sala 513
HORÁRIO: 14:00

RESUMO:
Embedded applications have been migrating from single processor-based systems to intensive data communication requiring multi-processing systems. The performance demanded by applications motivate the use of Multi-Processor System-on-Chip (MPSoC) architectures. Run-time changes in the quality of service provided by the MPSoC platform to the applications motivate the implementation of self-adaptive MPSoC platforms. Self-adaptive MPSoC platforms employ systems composed of sensor-actuator-rich architectures that observe the changes in the execution environment and adapt the system dynamically balancing the multiple objectives across multiple architecture levels. These self-adaptive systems require communication/programming models well suited to the distributed characteristic of the environment in order to coordinate communication between the elements that compose it. This Thesis investigates current programming/communication models on MPSoC and other correlated domains regarding the coupling between the communicating elements and the adjacent hardware and software infrastructure. The hypothesis raised is that it is necessary to use a model that, besides abstracting the communication complexity, also provides a more flexible coupling between the communicating elements of the self-adaptive system. Additionally, we argue that the current approaches used to incorporate self-adaptive systems in MPSoC platforms follow a non-systematic development methodology, which impacts the quality of software related to code reuse and maintainability. Therefore, this Thesis proposes to apply the publish-subscribe model in a middleware-based development approach to perform the communication employed between the elements of a self-adaptive MPSoC platform and to improve software quality of self-adaptive systems while minimizing undesired impacts of the proposed approach on the system. The Thesis is supported through a case study where we implement a self-adaptive system following the proposed approach and compare the results with a baseline self-adaptive system according to performance, energy and software quality metrics. The results show that the proposed model employed on a middleware based development approach has improved the software quality of the self-adaptive system by 33% to 47.8%, depending on the metrics evaluated, with a reduced overhead regarding metrics of performance (4.5%) and energy spent (5.9%). We also show that the requirements for middleware software are suitable for MPSoC platforms with memory usage constraints.

Keywords: MPSoC, many-core systems, programming model, communication model, publishsubscribe, middleware, self-adaptive systems, resource management.