

Ph.D. Thesis Review

Author: Michal Sojka

Title: Resource-Reservation and Analysis in Heterogeneous and Distributed Real-Time Systems

University: Czech Technical University in Prague

Reviewer: Michael González Harbour, Universidad de Cantabria

General comments

The thesis contains many contributions to an adaptive resource reservation framework that was developed in the FRESCOR European Project, and contributes also by further extending and enhancing the framework after the end of the project.

The subject of the thesis is of paramount importance for practical embedded applications with real-time requirements. The framework developed helps in managing the complexity of heterogeneous distributed applications using multiple resources such as CPUs, networks (wired, wireless, sensor-networks), memory, disk, and even FPGA reconfigurable modules. The application developer is able to develop independent components that use multiple resources, and the framework will ensure that its timing requirements are met, and will also provide for the timing isolation and the adaptivity that is needed to make use of the available resources in a flexible way.

An important contribution to the framework has consisted of enhancing its internal architecture to accomplish better separation of concerns, isolating as separate modules the management of each resource. This design has been demonstrated through the integration of six different resources.

A second important contribution of the thesis with respect to the framework was the design, implementation and integration of the wireless LAN resource.

The thesis has also provided valuable evaluation of the framework with different resources, using a real case study. The merit of this approach has to be emphasized, because many authors just rely on simulation experiments for the evaluation, by in this Thesis an actual implementation has been developed. This, of course, represents a lot of work that pays off with very relevant evaluation results.

The last chapter in the thesis provides an analysis technique for tasks with offsets in distributed systems, using Integer Linear Programming Solvers. The results are not very good when compared with existing techniques because important restrictions had to be introduced (deadlines within the periods) and the overall result is slower than previous techniques.

Summary

Even though the final chapter of the thesis does not provide interesting contributions (the thesis might have benefited from not including this chapter), the main body of the work, centred around the resource reservation framework, presents significant contributions that make the overall assessment of this thesis extremely positive. The results make the framework much more usable and extendible, and may have direct impact in actual industrial processes developing embedded real-time systems. Therefore, the results of the thesis are relevant to current needs of the scientific community and of industry practice and are important for the further development of the field of embedded real-time systems.

The main objectives of the work have been fulfilled, as shown through the evaluation sections in the different contributions, and in the overall case study.

The methodology used in the thesis is considered appropriate. In particular all the contributions are well founded on solid theoretical grounds, and are proven through exhaustive evaluation and, more important, through actual implementation. The thesis satisfies the conditions of a creative scientific work, as is shown through the publications of some of its results in peer-reviewed conferences of significant impact in the embedded real-time systems community.

The author of the thesis proved his ability to perform research and to achieve scientific results. I recommend the thesis for presentation with the aim of receiving the Degree of Ph.D.

Santander, January 28th 2011

Michael González Harbour