

Redogörelse för förändring av Jukka Mäki-Turjas forskning

Bifogar en projektbeskrivning med anledning av ARTES styrelsens begäran om redogörelse för effekten av min förändrade handledningssituation. Mina handledare är nu Christer Norström och Hans Hansson vid MRTC. Industripartner i det förändrade projektet är dels som i det tidigare projektet Volvo CEC, dels Datex Ohmeda.

Västerås 2000-05-22

Jukka Mäki-Turja

Project description

In the real-time research community there is a dispute whether the event triggered (ET) or the time triggered (TT) execution strategy is to prefer. There exist many papers on the topic, e.g., by Herman Kopetz and Alan Burns, which describe the *pros* and *cons* of each approach. Real industrial applications rarely depend on a single execution strategy, i.e., they typically use both TT and ET. A control loop is an example where a TT execution is well suited, while the handling of an emergency button is more suited for ET execution. This project aims at combining the ET and TT strategies in a single design model (including the task model) and apply combined techniques to map such a design into a resource structure. For example, using static scheduling techniques for TT execution and dynamic scheduling (e.g. FPS) for ET execution. The resulting task model will be applied in a design model, or rather an architecture description language, which will be used for designing the application. Furthermore the mapping from design down to a resource structure, as well as analysis (e.g. schedulability), will be supported by tools.

Means

The basis for the project will be a project called RTT (Real-Time Talk). In that project a design model was developed for the TT execution strategy. The RTT design model, that today maps to a static schedule will acts as a basis for the new design model. The design model will be extended by ET tasks and thus the mapping can not be done to a static schedule. Instead, the mapping will be onto a FPS system with offsets. Note that such a system can handle both TT and ET tasks, and with only TT tasks it is equivalent to a static schedule. This raises some issues that has to be handled:

- How does the schedulability analysis look like. The general case has been considered by Gonzales Harbour, but is computationally intractable. If restrictions are made to the general task model the analysis can however be simplified, potentially leading to a tractable analysis.
- The scheduler has to be able to schedule the TT tasks in the presence of ET ones.
- How does one assign priorities? This problem is not yet solved for dependant tasks.
- The resource handling can be done in two ways: 1) Among TT tasks access to shared resources can be separated in time 2) Otherwise a resource access protocol has to be used, e.g., the priority ceiling protocol.

The resulting design model should be applicable for embedded real-time systems and deal with requirements for such systems. It will be applied to an industrial application, provided by Datex Ohmeda, and will be mapped to the Asterix RT-kernel resource structure to validate the usefulness of the model together with its tools. Asterix is developed in another project at MRTC.

Relation to previous project

The relation the *incremental static scheduling project* is the schedulability analysis part. In the previous project we had to be able to handle interrupts in a static schedule, i.e., ET and TT execution in one system. The schedulability analysis developed in that project can be applied in a more general context, i.e., the new project.

Deliverables with time plan

The min deliverable of this project will be a PhD thesis including the following papers:

Week	
1-10	Paper on how to combine and the benefits of ET and TT execution.
11-25	Paper on the resulting design model, i.e., the architecture description language.
26-35	Paper on analysis, especially schedulability analysis, on the "new" task model.
36-52	Case study paper on a system from Datex Ohmeda.