

HaRTES: Hard Real-Time Ethernet Switch

FCT project PTDC/EEA-ACR/73307/2006
Kick-off workshop
Aveiro

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17th April, 2009



Motivation

■ Project

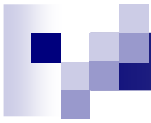
- ☐ Submitted in 2006
- ☐ Accepted in 2008
- ☐ Started informally in the meanwhile
- ☐ Officially started on the 1st of January 2009

- Are the initial objectives ok?
- Is the planned structure adequate?
- What shall our roles be?



Opportunities

- **Interest on bringing Ethernet into the cars**
 - **The case of BMW**
- **Growing interest on partitioning in distributed embedded systems**
 - **Integration of multiple applications / traffic types**
 - **Temporal isolation among applications**
- **NXP's interest on automotive communications**
- **Group at UIB is starting a national project to pursue work on star topologies**
- **Interest on flexibility is growing fast**



Threats

- **Competition from strong players may shrink the space for contributions**
 - **Both at the industrial level**
 - TTEthernet
 - PROFINET IRT
 - **And at the academic level**
 - Adaptive middlewares
 - Composability frameworks



Plan for the day

- **Selected presentations in the morning**
 - With interaction
- **Open discussion in the afternoon**
- **Wrap up at the end**
 - Back to the initial questions...

- **Invited participants**
 - Liesbeth Steffens (NXP)
 - The UIB group (Mallorca)
 - Arvind Easwaran (ISEP)
 - Colleagues with related interests (UA and ISEC)



Presentations

- **The HaRTES project: Hard Real-Time Ethernet Switching**
 - Paulo Pedreiras (UA)
- **Real Time communications over Switched Ethernet supporting dynamic QoS management**
 - Ricardo Marau (UA)
- **Enhanced Ethernet Switching Technology for Adaptive Hard Real-Time Applications**
 - Rui Santos (UA)
- **CANbids: CAN-Based Infrastructure for Dependable Systems**
 - Julian Proenza (UIB)
- **Improving Error Containment and Reliability of Controller Area Network (CAN) by means of Adequate Star Topologies**
 - Manuel Barranco (UIB)
- **Orthogonal Clock Synchronization for Dependable CAN**
 - Guillermo Rodriguez-Navas (UIB)



Schedule

- | | |
|----------------------|-------------------------------------|
| ■ 9h15-10h30 | UA presentations |
| ■ 10h30-11h00 | Coffee break |
| ■ 11h00-12h30 | UIB presentations |
| ■ 12h30-14h00 | Lunch |
| ■ 14h00-16h00 | Open discussion |
| ■ 16h00-16h30 | Coffee break |
| ■ 16h30-18h00 | Further discussion if needed |



Discussion

■ Paulo's presentation

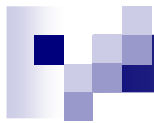
- Anticipate the dependability analysis, possibly carrying out a rough one in the beginning to guide the architecture alternatives (Manolo)
- Security should be considered (Quim)
- Clear signs that industry is getting more interested in flexibility confirmed by TTEthernet and PROFINET, but Ok if we are 10 years ahead ! (Liesbeth)
- The avionic industry is interested on adding new components to existing schedules without compromising them (Arvind)
- Formal verification is a particular opportunity for UIB contribution (Julian)

■ Ricardo's presentation

- Master replication needs to be considered (Julian)
- Compromise between the benefits of dQoS in resource usage and the penalty caused by the utilization bounds (Liesbeth)

■ Rui's presentation

- Clock synchronization could be important, mainly for multi-switch archit. (Guillermo)
- Server-based scheduling was not in the original proposal but it seems more important now... (Luis)



Discussion

- Julian's presentation
 - We need more concrete dependability data for better assessing the communication technologies (Julian and Liesbeth)
 - Develop techniques that are more technology-independent (Julian)
 - Exploit the similarities between the projects to maximize outputs reusing work (Luis)
 - Formal methods are becoming more common, maybe they could be more used within the project (Guillermo)
- Manuel's presentation
 - CANcentratre is too technology dependent. How could similar results be transposed to other technologies? (Luis)
 - Could the dependability analysis technique be applied to HaRTES? (Luis)
 - The models should be generally applicable to other technologies but coverages and failure rates must be adapted as well as the error propagation (Julian and Manolo)
- Guillermo's presentation
 - The OSC can be directly applied to HaRTES, the clock masters can be in the switches (Guillermo)
 - Not standard, though...



Discussion

- New points to consider in HaRTES
 - Multi-switch architecture
 - Master replication (reuse part of FTT-CAN master replication?)
 - Clock synchronization
 - Security (just awareness?)
 - Retransmissions and inconsistencies (what to do?)
- Points of contact with (Re)CANcentrate
 - Error containment
 - Dependability analysis (to be done iteratively while refining the specification)
 - Switch replication (including the replicated media management at the nodes)
- Points of contact with OSC-CAN
 - Clock synch among the switches and switch/slaves
- Other things we could integrate?
- Other contact point that we should explore?
- Are the HaRTES objectives still relevant?
- Shall we propose new projects??!! (fault-injection?)