Towards a Toolchain for Asynchronous Embedded Programming based on the Peer-Model

Thomas Hamböck

Problem Statement
- Cost-effective alternative to copper cables based on low-power wireless nodes
- Motivating use case from railway domain:
  - Notification of train arrival at level crossing
- Requirements strongly depend on environmental setting
- Flexible model and toolchain for embedded programming is missing

Methods
- Space-based coordination middleware
- Embedded variant of the Peer Model (ePM)
- Domain Specific Language (DSL)
- Code generation: DSL → ANSI C
- Evaluation in three different use cases:
  - Railway notification
  - Light switch
  - Industrial automation
- Fieldtests beside a railway track

Peer Model (PM)
- Foundations: concurrency, decoupling, scalability
- Modelling of timed, concurrent and distributed flows
- Main concepts: Peer, Container, Entry, Wiring

Toolchain

Fieldtests near Weikendorf showed promising results

Evaluation & Conclusion
- Code size metrics showed high code reusability
- Better energy consumption than native implementation
- Fieldtests demonstrate stability and feasibility
- Suitable model for distributed embedded applications
- Future work
  - Implementation of security concepts
  - Tests with new wireless transceivers

Reference & Funding
- Eva Kühn, Stefan Craß, and Thomas Hamböck.
  Approaching Coordination in Distributed Embedded Applications with the Peer Model DSL.
- This work was partially funded by:
  LOPONODE Middleware funded under the programme “FFG BRIDGE”, project number 834162
  LOPONODE Proof-of-Concept funded by the industrial partner ÖBB Infrastruktur AG

Contact: th@complang.tuwien.ac.at