Structuring Variability in the Context of Embedded Systems during Software Engineering – Problem Statement

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Agenda

Variable Software of Embedded Systems

Context of Embedded Software

Example for Context Variability

Related Work

Open Issues and Future Work
Software of Embedded Systems

- Today's embedded systems are often part of a system of systems

- Main functionality of Embedded Systems is realized by software

- Software is deployed in highly-complex and safety critical environments...

- ...and has a High interaction with environment by sensors and actuators

cf. [Weyer & Pohl 2008]
Variability in Environment of Embedded Software

- Use of different hardware in supply chain of the embedded system

- Use of a system (and software) at different OEMs
Context is more than the system’s runtime environment

- Context is defined based on context subject
- ...and is defined by context and system boundary
- Context aspects are relevant elements in the context of the context subject

1. Software has to comply to its context
2. Context is a source of system variability

PALUNO
The Ruhr Institute for Software Technology

[Pohl 2010]
A Framework for Structuring Context
Context Facets

Subject facet

Car itself

Driver

IT system facet

Technology to be used

Used operating system in the car

Driver assistance system

...
Context Variability by Example

- Software of dynamic tinting system
- Based on a case study from industry
- System should be used in different by different vendors
- Main functionalities
  - Tint windows depending on sun glare
  - Untint windows if car enters a tunnel (tunnel detection)
What is the relation of context variability to system variability?
Requires-Relation

Or-Relation

Context variability, i.e. variable context aspects, needs to be explicitly considered during engineering.
Open Issues

Support context variability in the Engineering of embedded software

1. How can sources of system variability systematically be documented by analyzing the impact of context variability to system variability?

2. How to does the context subject change in a variable system?

3. How can the identified relations contribute to a context theory for variable embedded software?
Related Work of Modelling Context Variability

1. Most scoping approaches do not consider context explicitly
   - Clements & Northrop regard context but neglecting its variability
     [Clements & Northrop 2001]
     [John & Eisenbarth 2009]

2. Pre-configuration of System Feature Model based on Context Feature Model
   - Pre-configuration based on conceptualization of Zave/Jackson-framework
     [Kang et al. 1990]
     [Kang & Lee 2013]
     [Lee & Kang 2010]
     [Hartmann & Trew 2008]

3. Formalization and consistency check of context behavior against system behavior
   [Ubayashi et al. 2010]
   [Ubayashi et al. 2012]
Future Work

Extend or define engineering approach by a systematic consideration of context variability during software engineering

1. Extend current variability modeling approaches to deal with context variability
2. Define a context theory for variable (software) systems

- Refine problem statement based on feedback of industrial partners
Questions? Ideas? Feedback?
References


