Software Technologies for Embedded Systems: An Industry Inventory

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Introduction

> TU Delft
  - Master 1996-2002
  - Ph.D 2002-...

> MOOSE (ITEA project 2002-2004)
  - Requirements Engineering
  - Architecture
  - Software Process Improvement
Goal

- Find opportunities for future research in embedded software development
  - Impression of current state in industry
  - Criteria for using or not using technology
Cooperating Companies

Nokia
Connecting People

CMG
when it really matters

solid.

TEAM ARTECHE

VIT

Philips

OCÉ

ASML
Approach

- Interview Outline
  - BOOTSTRAP/ PROFES process model
  - Focused on development of embedded systems

- Interviews
  - Different company
  - Different roles
  - Different products
General Results (Requirements)

- Requirements Elicitation
  - Interviews, Meetings, Prototyping

- Requirements Specification
  - (Structural) Natural Language, Use Cases
  - MS Word, Templates, Pre-/Post Conditions (e.g. interface specifications)

- Requirements Analysis
  - Meetings, Reviews, Checklists

- Requirements Management
  - Manually, MS Excel Sheets, Rational RequisitePro, Telelogic DOORS
General Results (Architecture)

- Architecture Specification
  - Natural language, UML, free form sketches
  - MS Visio, Rational Rose

- Architecture Analysis
  - Meetings, Reviews
  - Sometimes more structured MTT
General Results (SPI)

- Tailored SPI method, CMM(I), ISO, SPICE
- Process (quality) manuals written in natural language
  - Process
  - Procedure
  - Guidelines
  - Templates
  - Checklists
- Process toolkits in HTML on intranet
General Results (rest)

- Reuse mostly done ad-hoc
- Basic metrics used
  - Project Management (lead time, effort)
  - Implementation (lines of code)
- Configuration Management
- Testing and Integration
- C, C and more C
- Sometimes Assembler, C++ or Java
- Editors and Compilers
Industry is conservative

- No fancy tools used
- Proven technology
- Mostly general tools used
- Pragmatic approaches
Available

- OO-languages: C++, Java, ADA, etc...
- UML, UML-RT, HOOD
- Code Generation
- Model Based Simulation
- RUP, XP
- Specification Languages (Z, OCL, VDM)
- Integrated Development Environments (IBM VisualAge, Telelogic Tau, Rational Rose)
- Advanced Requirement Management Tools
Paradox?

> Industry develops high-tech products with 'low-tech' development technologies!
> The high-tech embedded systems produced are getting more and more complex
> Many 'high-tech' development technologies available
> Why not use them?
Reasons of not using (1)

- No need
- Legacy
- Maturity
- Availability of supporting tools
- Skills
- Complexity
Reasons for not using (2)

- Time-pressure
- Benefits not clear
- Risk
- Deployment to costly
- Sentiment
Conclusions

> Large variation of MTT
> Common SW engineering MTT
> Large gap between what’s available and used
> Only small changes possible in practice
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